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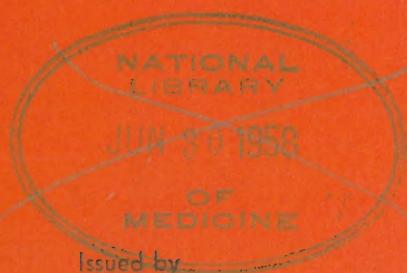
Illinois Guide

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**HEALTHFUL SCHOOL
ENVIRONMENT**

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**CIRCULAR SERIES A
NO. 54**



Issued by

VERNON L. NICKELL
Superintendent of Public Instruction

Illinois Guide

TO

HEALTHFUL SCHOOL ENVIRONMENT

☆ 1949 ☆

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Illinois. Dept. of Public Instruction

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FOREWORD

This bulletin has been developed by a sub-committee of the Illinois Secondary School Health Guide Committee as a guide to local administrators and boards in expanding and improving building health facilities for elementary and high school children. Practically every part of the school building is related to the problems of safety, sanitation and mental and physical health. It is important that a competent school architect be employed early to insure economical and sound planning to meet the needs of the students and the public.

District reorganization, increased enrollments and the desire to improve facilities for existing and enriched educational opportunities have shown the needs for new buildings, additions to existing buildings, and remodeling.

In September 1944, a grant was given the Office of Superintendent of Public Instruction by the W. K. Kellogg Foundation to be used for the improvement of health programs in the schools of Illinois. Illinois was one of five states selected in 1947 to receive an additional grant to carry on the Extended School and Community Health Project. This bulletin is the outgrowth of the health program in Illinois carried on with the cooperation of the State Health Department, Universities and Teacher's colleges, county superintendents, school districts, and professional organizations, such as the Illinois Secondary School Principals' Association.

The law requires the submission of building plans to the County Superintendent for approval. Consultative and advisory services are available through members of our supervisory staff at all times. These services are being expanded since it has become a common practice to submit building plans to this office.

We wish to express appreciation to the Kellogg Foundation, cooperating agencies, organizations and individuals for the assistance that has been given in the preparation of this bulletin.

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We particularly wish to acknowledge the National Facilities Conference and The Athletic Institute for permission to use material contained in *A Guide for Planning Facilities for Athletics, Recreation, Physical and Health Education*.

Chapter I

PLANNING

For many years, the health aspects of school facilities have been incongruous with educational objectives. All too frequently, principles of healthful living have been taught and are being taught in classrooms which are not properly lighted, heated and ventilated, and which are not healthfully and adequately equipped. They have been taught, and are being taught in school buildings in which it is impossible to carry on many of the habits of living which medical and educational research have sanctioned as being necessary to the practice of good health.

During the next decade, there will be of necessity, a large amount of school building and remodeling. Increased enrollments, consolidation and reorganization of administrative units, improved teaching techniques and increased community use of school facilities will all make their demands on school authorities and other governing bodies to improve and to enlarge existing school facilities. Such demands are already being felt in many areas; the erection of new buildings and the rehabilitation of old buildings has already begun.

During the previous decade, due partially to the war, the American people have steadily become more and more health conscious until now the provision of a healthful school environment is recognized as a first responsibility of school authorities. Whether new school plants are erected or whether existing ones are remodeled, health standards are of the utmost importance and must be carefully and scientifically considered. There is really no part of a school building which does not, in some way, involve the health of the pupils housed in it.

Fundamental to the planning of a school building is a full understanding of the community and the society which it is to serve. The building planner must hold to the central concept of education in a democratic society, i. e., the sanctity of the individual personality, which to the publicly supported school means education to the fullest of the individual's ability, regardless of his handicaps or of his station in society.

Building planning begins with surveys of existing plant facilities and statistical analyses of population trends, needs and desires. Then with full information at hand, building planning becomes a community enterprise. Through a series of meetings or workshops, school boards, building experts, patrons, faculty, representative student and other interested personnel together develop plans for the kind of environment which will equip the individual to find his meaningful place in society.

The following suggestions are intended as a generalized outline for the healthful arrangement of the entire school plant. It is recognized that they will need augmenting in application to a particular project, and that they are subject to change as educational philosophies, practices, building standards and equipment requirements change.

Chapter II

GENERAL BUILDING ARRANGEMENT

ORIENTATION

Cost, topography, adjacent property, location of streets and alleys, transportation and traffic are important conditions affecting the location of a school building and its grounds. Various units, suits and rooms should be studied closely with reference to the maximum utility of natural light. Extensive analyses should be made of noise factors emanating from busy streets, factories, shops and railroads, and of smoke or injurious or obnoxious odors arising from factories, shops or sewage disposal plants. Every advantage should be taken of public utilities in connection with electricity, gas, water and sewerage lines. The center of the non-transported school population should be considered.

School enrollment trends and policies, present and future curricular and extra-curricular needs and the trend toward a greater use of school facilities by the community are factors which will help to determine the size of the school site. Locating school sites adjacent to existing parks or playgrounds may be advantageous in some areas. The American Association of School Administrators recommends a minimum of five acres for elementary schools and of ten acres for secondary schools with an additional acre for each one hundred pupils of ultimate enrollment.¹ Consequently, an elementary school having an enrollment of 300 pupils would require a minimum site of eight acres.

GENERAL DESIGN

The building should be designed for economy of construction in a style of architecture harmonious with the site and the environment. It should strive to house the maximum number of cubic feet of space, keeping non-usable space at a minimum. Its attractiveness should come from the fact that it is planned for functional use; costly ornamentation is unnecessary.

Its layout should take advantage of every site contour and care should be taken to afford ample surface drainage away from the building. Due to dampness and darkness, basement rooms are seldom satisfactory for classroom use. Building service rooms may be located in basement areas. A building of more than two stories in height complicates provisions for health and safety, for expansibility and for flexibility. Single story buildings lend themselves well to a good balance between academic and vocational areas, since it is desirable to have coordinated groupings of rooms on a functional basis and yet obtain a definite isolation of noise areas from quiet areas.

Provision should be made to carry off fumes, odors, dust and smoke from cafeterias, laboratories, shops and furnace rooms. Light and heat

¹ American Association of School Administrators, *American School Buildings, Twenty-seventh Yearbook*. Washington, D. C. 1949.

should have sectional control so as to permit the use of parts of the building without heating and lighting all parts.

The building should be designed to permit easy erection of future additions without loss of existing construction or space. Locations of future additions should be planned with consideration for entrances, stairs and corridors. Additions are considered to be more feasible in a low height, open type building, than in a compact or block type building.

The modular or unit system of design should be used in laying out the plan of the building in a pattern readily adaptable to rooms of various lengths. Varying widths of classrooms assigned to different purposes can be accomplished by providing a variety of clear spans. Arrange the classrooms in rows of three or more end to end, using care not to block this intent by the location of stairs and entrances. Load-bearing partitions should be avoided throughout the building. Utility ducts for wires and pipes should not be placed in cross partitions between classrooms, but should be so located on corridor and outside walls as to permit the moving of cross partitions. Utility ducts for future use should be provided in case room lengths are changed. Fenestration (all sources of natural lighting and their control) should be in a continuous pattern along entire walls and not grouped premeditatively for individual rooms.

In the long run, it is believed to be more economical to employ a competent school architect to assist in the early community and building surveys as well as in the later planning and supervision of building construction.

WALKS, DRIVES AND PARKING SPACES

Provision should be made for one-way through drives for the delivery of supplies to all areas of the building where services will be needed and for an unloading area for buses on the site or on an adjoining street. Employees should have a parking space on the site and there should be space for bicycle parking or storage. There should be adequate feeder streets of ample width to accommodate extensive parking facilities near the site, and a parking space on or adjoining the site adequate to take care of normal parking requirements. Drives need to be designed to discourage speeding.

Sidewalks on the site should be wide and along lines convenient to student traffic. Sidewalks should not be a part of or too close to drives. If possible, vehicular and pedestrian traffic should be routed to different dispersal points.

SAFETY FROM FIRE

Before new construction or extensive alteration is begun, plans should be submitted to the Department of Public Safety, Division of Fire Prevention, for approval. Doing so will not only assist in the prevention of school fires but will also be more economical.

In general, the most economical type of fire-resistant construction that is satisfactory under the particular conditions should be adopted. Fireproof construction is preferable. Roofing should be of non-inflammable materials; wiring should be enclosed but easily accessible.

Every building and every upper floor in it must have two well-separated means of exit. Corridors and stairways should be fireproof, spacious and properly designed. They should lead directly to exits where doors, which are provided with panic hardware, open outward. Fire escapes are required by law on all buildings which are more than two stories high unless the stairways are fireproof, enclosed and meet the requirements of the Division of Fire Prevention.

Corridors must be free of fixed or movable obstructions; exits should be at the end of each corridor and there should be no dead-end corridors. If stairs are at the end of a corridor, they should run at right angles to it.

Classrooms seating more than forty and special rooms, such as chemical laboratories, shops and homemaking units, must have two exits from which doors open outward. Fireproofing of materials used for drapes and stage curtains is recommended.

Exit formulas are complicated and in multiple-story buildings, gymnasiums, auditoriums, and other areas where people congregate in large numbers, exit provisions should be carefully checked by codes of the National Fire Protection Association and of the National Fire Underwriters, as well as by state and local codes. Exits should be clearly marked, and if signs are lighted, they should be on a circuit separate from regular circuits.

Danger points such as heating plant and fuel storage rooms should not be located under corridors or stairways and must be sealed off by self-closing fire doors. A separate fireproof building is preferable, but if it cannot be provided, the heating plant and fuel storage rooms should be separated from other parts of the building by walls of at least 8 inch masonry; ceilings should be of concrete or of $\frac{3}{4}$ inch cement plaster on metal lath.¹ Stairways leading from the basement should have doors placed at the head or the foot of the stairs.

Building maintenance standards and janitorial service should always be kept at a high level but particular attention is called to the danger of permitting large amounts of inflammable materials to accumulate. Because of accumulation of grease frequent cleaning of kitchen exhaust ducts is recommended. The storing of hot ashes in combustible containers should be avoided.

The installation of a sprinkler system is not necessary, but fire fighting equipment should be provided in the form of chemical extinguishers and fire hose and no point should be more than 100 feet away from such equipment. Additional extinguishers should be placed at danger points. Various types of fires require different types of extinguishers; wood fires require the use of water, electrical fires require the use of carbon dioxide and oil fires require the use of foam or carbon dioxide to be effectively extinguished. Carbon tetrachloride extinguishers may be used in electrical fires but caution must be taken in enclosed places. All fire fighting equipment should be on a regular check, test and refill schedule.

¹ Department of Public Safety, Division of Fire Prevention, *Fire Safety Requirements for Schoolhouses*. State of Illinois.

Fire alarm systems should permit operation from proper locations along the corridors and at other strategic points and should have a practice switch in the office. Due to the danger that electricity might be shut off during a fire, it is suggested that alarm systems be operated from an automatically charged storage battery; in small schools alarm systems may be manually operated. Previous to the installation of fire fighting equipment, the local fire authorities and the State Fire Marshal should be consulted.

Chapter III

CONSTRUCTION DETAILS

Where the site is ample in size, the open type building, one or not more than two stories in height, is desirable. Where sites are restricted in size, some compromise may be necessary as to height. One and two story structures may be erected with outside bearing walls, with tile or movable interior partitions and floors of reinforced concrete, or, they may be of skeleton construction of reinforced concrete or steel throughout. Architectural concrete for the entire structure is also suitable. In this type, all exterior walls, floors, roof and interior columns are of reinforced concrete. Where the site requires a multi-story building, the framework should be of steel or reinforced concrete.

In all buildings exterior walls and roof should be designed for low heat loss. If parapet walls are used, wall flashing under the coping and flashing under the window sills and other projections is advisable. Construction should be fire-resistant or fire-proof, construction and equipment should be durable and the building should be insulated. Planning should include provision for easy access to fixtures such as pipes and wiring. All portions of the building should be easily accessible for cleaning and painting. Standard sizes and colors are recommended. Partitions should be removable where it is possible. Dead-end levels which force the maintenance crew to lift debris need to be avoided.

WATER SUPPLY AND DRINKING FACILITIES

Proper sanitary facilities are of the utmost importance in a healthful school environment. The safety of the water supply and the drinking water facilities and the efficiency of the toilet and waste disposal units have a tremendous effect on the prevention and control of disease.

One of the most pertinent factors in the conduct of a healthful school is the sanitary quality of its water supply. Whether the supply comes from a municipal system or from a private well or cistern, the safety of a water supply is based on the location and construction of the various parts of the system and on frequent bacteriological analyses of the water. A bacteriological analysis of a sample of the water indicates the condition of the water only at the time the sample was collected and does not necessarily give a true picture of its continued safety which is dependent upon freedom from sanitary defects. A water supply system should be located properly with respect to sources of pollution and should be constructed in such a way as to prevent any contaminated materials from entering it. To check the safety of the supply, any known sanitary defects should be eliminated, and then periodic samples should be collected for analyses. As in other phases of school building, specialists should be consulted.

Although municipal water supplies are under the constant surveillance of the Illinois Department of Public Health and should be used

wherever they are reasonably available, their use does not necessarily insure a safe school water supply. A considerable number of cases of water-borne diseases have developed as a result of improper piping and of unsafe plumbing installations. Great care must be exercised in planning and installing the school piping system to be certain that the water supply reaches the user without being contaminated. Cross connections through which polluted water may enter the drinking water source must be avoided. In schools where there are swimming pools, there must be no direct piping connection with the drinking water system. Occasionally cross connections between two sources of supply have been installed with the idea of avoiding an interruption in the water supply if one of the sources is inadequate; dual systems are not advisable.

Plumbing installations must be carefully checked to be sure that there is no possibility of contaminated water being drawn into the water supply piping system under reduced pressure conditions.

Whether schools have public water supplies and pressure systems or whether they must rely on a private well or pumping system, proper drinking water facilities can and should be provided. These should consist of carefully installed and properly designed drinking fountains or bubblers; there are attachments for hand pumps.

A list of the essential features of a properly designed drinking fountain follows

1. The fountain should be constructed of impervious material, such as vitreous china, porcelain, enameled cast-iron, other metals, or stoneware.
2. The jet of the fountain should issue from a nozzle of nonoxidizing, impervious material set at an angle from the vertical. The nozzle and every other opening in the water pipe or conductor leading to the nozzle should be above the edge of the bowl so that such nozzle or opening will not be flooded in case a drain from the bowl of the fountain becomes clogged.
3. The end of the nozzle should be protected by nonoxidizing guards to prevent persons using the fountain from coming into contact with the nozzle. The guard should be designed so that the lips when drinking will not touch the guard.
4. The inclined jet of water issuing from the nozzle should not touch the guard, thereby causing spattering.
5. The bowl of the fountain should be so designed and proportioned as to be free from corners which would be difficult to clean or which would collect dirt.
6. The bowl should be so proportioned as to prevent unnecessary splashing at a point where the jet falls into the bowl.
7. The drain from the fountain should not have a direct physical connection to a waste pipe unless the drain is trapped.
8. The water supply pipe should be provided with an adjustable valve fitted with a loose key or an automatic valve permitting the regulation of the rate of flow of water to the fountain so that the valve manipulated by the users of the fountain will merely turn the water on or off.
9. The height of the fountain at the drinking level should be such as to be most convenient to persons utilizing the fountain. The provisions of several steplike elevations to the floor at fountains will permit children of various ages to utilize the fountain.
10. The waste opening and pipe should be of sufficient size to carry off the water promptly. The opening should be provided with a strainer.

11. The water supply line should not pass through the waste piping or drain.

In cases where a municipal water supply is not available, it is necessary to resort to a well or a cistern. Such a well or a cistern should be located at a site which has good surface drainage. It should be on higher ground and at least 50 feet from sources of pollution, such as privies, tile sewers, septic tanks, etc. Sewage or drainage water often flows into wells through unsealed underground openings. Sanitary sewers, sink drains and basement drains closer than 50 feet should be constructed of cast iron pipe having watertight leaded joints. Under no condition should any drain line be placed nearer than 25 feet from a well or a cistern. These minimum distances also apply to jet and pump suction lines of pressure systems where the pump is located away from the well.

There are normally only two ways that contamination may enter a well, assuming that it is located properly with respect to sources of pollution. First, and by far the most common, is through some opening in the platform that will permit surface water, rain and waste pumpage to wash dirt, shoe scrapings and animal pollution into the well directly. Secondly, a porous well lining near the surface of the ground will permit contaminated shallow ground water to seep into the well before it is properly filtered. In constructing the water supply well or cistern, these two avenues must be effectively blocked.

The iron casing and pipes used in drilled and driven wells prevent shallow ground water from entering. However, dug wells and cisterns are usually walled with brick, stone or tile, all of which permit shallow ground water seepage. It is almost impossible to make such wells permanently watertight, even though cement mortar and plaster be used by expert workmen. The most satisfactory method of eliminating this source of contamination in dug wells is to employ the buried-slab type of construction, described in Illinois Department of Public Health bulletins. In this type of construction the dug well is capped with a concrete slab placed about 10 feet below ground surface. A 5-inch-diameter seamless metal pipe or well casing projects through the slab to about 1 foot above ground level. The slab is permanently buried under 10 feet of thoroughly tamped earth backfill. The pump pipe is inserted through the metal casing which is sealed to the pump base as in a drilled well. The buried slab construction eliminated the necessity of constructing an assuredly watertight well top and well wall, to a depth of 8 feet, which is so difficult to obtain in the ordinary type of dug well. Cisterns should be constructed of reinforced concrete. If a suitable source can be obtained from drilled or driven wells, water from dug wells or cisterns should not be used for school sources.

Surface water, waste pumpage, animal pollution, and other foreign matter, are effectively kept out of driven wells by the nature of their construction. The pump of a driven well is screwed directly to the outer casing so that no opening exists to the well proper; however, drilled wells, dug wells and cisterns do have openings that must be closed. Faulty pumping equipment can result in pollution.

The annular opening between the outer casing and the pump suction pipe of a drilled well may be effectively sealed with a flanged fitting,

cakum and lead, or a commercial sanitary well seal. One additional method that may be used with a hand pump permits the casing to extend at least one inch above the platform and into the pump base. The pump is bolted securely to the platform over the extended casing. Any seepage under the pump base cannot enter the well because of this extended casing. Platforms for cisterns and ordinary dug wells should be watertight concrete and at least one foot above the surrounding ground level. Manholes are openings through which contamination may travel and are usually unnecessary; however, if they are desired, they may be satisfactorily constructed by placing a two-inch raised concrete lip around the manhole opening in the platform and by providing a concrete cover having overhanging edges. This gives a "shoe box cover" effect that will satisfactorily prevent surface contamination from seeping under the manhole cover. The hand pump opening through the platform should be formed in the concrete by a short iron pipe. This "pipe sleeve" should be large enough to permit the withdrawal of the pump cylinder and should extend above the concrete and into the pump base at least one inch. The pump should be of the "force" type and have a one-piece solid base fastened to the suction pipe in a watertight manner.

Two bulletins of the Illinois Department of Public Health entitled, "Wells, Dug, Drilled and Driven" and "Cisterns" give complete plans and specifications for the location and construction of private water supply systems. They are available for free distribution to Illinois residents upon request.

TOILETS AND WASTE DISPOSAL

There is little equipment in a modern school building which is as personalized or contributes so much to better physical and mental well-being as modern toilet room facilities. Separate toilet rooms for each sex should be provided and these should be equipped with toilet paper, mirrors and adequate handwashing facilities including hot and cold running water, paper towel and soap. Such items are a necessary part of every healthful school washroom. Provision for obtaining sanitary napkins and for the proper disposal of them is a necessary feature of washrooms for girls.

Floors should be constructed of smooth, impervious materials and should be well-drained. The walls and partitions should be of impervious, easily-cleaned material. Natural and artificial lighting should be adequate; ventilation should be sufficient to prevent excessive condensation and odors. The room and all equipment in it should be easily accessible for cleaning.

Each bank of stools and urinals should be adequately screened from opposite banks; it is preferable to provide partitions between each stool. In girl's washrooms, doors should be provided for each stool unit. Stools should be elongated in shape and fitted with open-front seats. The seat should be constructed of hard rubber or black composition that is impervious to moisture. Fixtures are obtainable in baby, junior and standard sizes.

The recommended minimum number of fixtures in the toilet rooms is as follows:¹

Boys' stools.....	one for each 50 boys
Girls' stools.....	one for each 25 girls
Urinals.....	one for each 30 boys
Lavatories.....	one for each 50 students

Many plumbing fixtures and toilet flush valves are so designed that a backflow or back siphonage of contaminated material to the drinking water lines is possible under certain conditions. All water supply lines can be readily protected against this back siphonage by one of the following methods:

a) Flushometer valves should be equipped with backflow preventers located in accordance with the manufacturer's directions and on the discharge side of the control valve and at least 4 inches above the flood level of the fixture. b) Float-operated valves in gravity-flush tanks should be protected with a vacuum-breaker ball cock installed with the effective air inlet to the vacuum-breaker unit at least 1 inch above the tank overflow level of the fixture. Submerged water inlets other than those equipped with flushometer valves shall have the backflow-preventer unit located on the discharge side of the water-control valve and at a point at least 6 inches above the flood level of the fixture.

All backflow preventers used should be tested and approved by a reliable plumbing testing laboratory. The Illinois Department of Public Health has a list of plumbing fixtures and equipment approved by some of the leading laboratories.

If a water pressure system is available in the school but there is no public sewer system, treatment of all water-carried wastes must be provided. General information on the type of treatment plant necessary for water-carried school wastes may be obtained from the State Sanitary Water Board. *The State Sanitary Water Board Law requires that plans and specifications for any sewage treatment plant serving 15 or more persons be submitted to the Board for review and approval prior to any construction.* This service is provided to insure the most economical and efficient installation.

The removal of garbage, ashes and rubbish is difficult unless there is a daily collection service available, either private or municipal. Problems arising from insects, rodents and unpleasant odors seriously affect the school environment; health hazards resulting from the accumulation of waste materials must be avoided. All too frequently, ashes are allowed to accumulate on school grounds; such a practice is a safety hazard.

For the most part, rubbish can be burned in coal heating plants or in properly constructed incinerators. A small amount of garbage can be burned in coal-heating plants. If trenches must be resorted to for the disposal of garbage and trash, such trenches must be covered with at least two feet of earth and carefully packed down to prevent access to rodents and flies. Each day's garbage deposited in these trenches should be covered at the end of the day during which it is deposited.

¹ *A Guide for Planning School Buildings.* Superintendent of Public Instruction, Springfield, Illinois.

GERMICIDAL LAMPS AND AEROSALS

The use of some type of germicidal lamps or aerosols in schools is still a matter of conjecture. Present research shows promise for their effective control of air-borne infections. However, installation should await the outcome of research and future developments should be watched closely by keeping in touch with qualified opinion from public health, medical and educational sources.

HEAT AND VENTILATION

The achievements of young people in school are greatly affected by the health and bodily comfort of everyone working in the school environment. Inadequate and improper temperatures and poor circulation of air throughout school buildings can result in much discomfort and in ill-health. Some people are very sensitive to temperature even to the extent of two or three degrees and they are somewhat sensitive to the circulation of air. In regard to the much talked of question of humidity, research attempts have so far produced questionable and unsatisfactory results and tend to indicate that the humidifying of air in classrooms is merely one of many health factors to be considered in relation to other environmental factors. If humidification equipment is installed, such equipment should be kept in good condition.

In the field of heating, there has been much extensive research; continuous experiments in source, methods, control and efficiency are being conducted by many colleges of engineering. There are various types of heating and ventilating systems available and again their selection of a particular school building depends on the local situation. Installation costs, relative operation and maintenance costs, access to fuel and ease of operation and maintenance are factors to be considered with heating engineers.

The two methods of heating most commonly used are hot water or hot vapor radiators in the rooms and the heating of air near the fire and delivering it through ducts to the rooms. Coal is still the most common type of fuel used; stoker-fired furnaces are considered to be more efficient than hand-fired furnaces. With the exception of radiant heating, in its infancy but showing promise, and some types of individual room heaters, many heating systems also provide forced ventilation. Window and gravity ventilation is satisfactory in some situations. In addition to proper fuel selection, firing, boiler water, draft regulation and cleaning are of vital importance in the efficient operation of any system of heating and ventilation; if these factors are not given proper attention, the best of systems will break down in its operational efficiency.

FENESTRATION, ARTIFICIAL LIGHT AND INTERIOR DECORATION

The problem of controlling conditions in the classroom which affect seeing, appears to be reasonably simple, but in reality is difficult and controversial. Until recent years, attempts to remedy the problem have centered around increasing the intensity of natural and artificial light. Modern scientific opinion, however, tends to indicate that the entire en-

vironment should be conditioned for visual comfort and efficiency; merely increasing the quantity of illumination at work levels is not sufficient. The reduction of direct and indirect glares, the minimizing of shadows and the equitable distribution of light or a proper brightness balance of natural and artificial light sources are as pertinent to visual comfort as is light quantity. Reflective factors of walls, ceilings, floors, furniture and so on, must be considered. Such factors cannot be overcome by fenestration alone, by artificial lighting systems alone, or by interior decoration alone; they require the adjustment of the entire classroom environment.

It is particularly important to remember that specialists should always be consulted before doors and windows are changed, before artificial lighting installations are improved, and before decorative adjustments in regard to ceilings, walls, floors, furniture and other equipment are made. Modern changes in curricula and changes in educational methods encourage greater pupil activity and more informality in classrooms resulting in a need for larger and wider classrooms; such changes and needs have definite implications for the improvement of the amount and distribution of light.

Fenestration, (all sources of natural lighting and their control) should be arranged so as to prevent a large amount of direct sunlight from entering the room at an angle near the direct lines of vision, because of resultant brightness, glare and shadows. Light which enters from the upper portion of windows is the most effective for the far side of classrooms. The use of clerestory windows and additional non-vision sources are advocated in conjunction with conventional windows; the former should be permanently shielded so that light is directed toward ceilings. Clerestory windows are those located on the inside wall which is parallel to that containing the conventional clear vision windows; they are near the ceiling and are placed above the level of the corridor roof. Non-vision sources include all types of natural light sources: windows placed near ceilings, strips of directional glass blocks, clerestory windows, skylights and so on.

There is much discussion and controversy concerning unilateral, bilateral, trilateral and multilateral fenestration. Existing building and classroom designs, available finances, climate and so on, influence the selection for a particular locality. In some of the newer schools in which bilateral and trilateral fenestration has been properly installed, it has been found that the diffusion of natural light is improved. Clear glass windows, with narrow and light mullions (strips between panes of glass) placed along a wall which is not faced by pupils, supplemented with directional glass blocks from the tops of the windows to the ceilings and with a similar arrangement of blocks on the opposite and/or rear sides of the room, is an arrangement frequently suggested.

If glass blocks are used, they should be of the type which will direct daylight upward and should be placed only above head height. There have been instances reported where non-directional glass blocks caused discomfort because of heat and glare. Their use is still highly controversial and should be studied carefully in conjunction with properly shielded clear-glass windows to provide suitable bilateral, trilateral or multilateral fenestration in the particular classroom.

Because of the many problems presented in heating, condensation, glares, maintenance and installation, skylighting is not generally advocated. Although sawtoothed skylighting presents some of the same problems, it does have the advantage of providing a clerestory type of supplemental light.

Generally, fenestration should be arranged so as to permit a maximum amount of light throughout the room with glass areas fairly near the finish lines of ceilings and should be designed for the proper installation of shades. Shades should be well-fitted, light colored and translucent; opaque shades or draw curtains are desirable only for darkening the room for certain forms of visual aids. Shades of the vertical type are not considered particularly satisfactory because of light leaks and silhouette effects; if they are properly installed and used, those of the horizontal double-roller type permit more effective brightness control. Venetian blinds have the advantage of directing sunlight to the ceiling, however, they must be kept properly adjusted. When pulled up they do cut off the most effective light which enters the top portion of windows and they are expensive to install and maintain.

Interior window sills constructed of waterproof materials and so arranged and finished that there is no reflection from the direct rays of the sun are very satisfactory.

The problem of fenestration for single story buildings is difficult but not nearly so complex as that for multi-story buildings; further research and experimentation are sorely needed. Since so many of our existing buildings are two or more stories in height and since they have classrooms on both sides of corridors, greater dependence will probably have to be placed on systems of artificial lighting and on making greater use of lighting the interiors through decorating.

In selecting a system of artificial lighting professional illuminating engineers in or near your community should be consulted. Some of the general items to be considered are:

The adequacy of the quantity and quality of illumination for night as well as for day use. Wire of size to carry peak demand.

The arrangement of switches so that natural light can be supplemented in areas of the room where it is deficient as well as in the room as a whole.

The adequacy and uniformity of illumination for the entire working area.

Freedom from direct and indirect glares and the reduction of shadows to a minimum.

The expense of installation and maintenance and the ease of cleaning and servicing. Particular attention should be given to the inclusion of ample electric outlets in each room.

The mechanical strength to meet the many demands made on it, particularly in regard to glass breakage.

The attractiveness whether lighted or not lighted.

The operative efficiency and cost per unit of light in comparison with other similar lighting systems.

Ideally, lighting units should not be noticeable and their brightness should blend with nearby surfaces. Fluorescent lighting is particularly adaptable to this ideal, but installation costs are generally higher. However, fluorescent lamps do give a greater amount of direct light with less surface brightness if properly shielded and they are generally lower in operational cost for the same amount of light. Fluorescent cold

cathode tubes are also expensive to install but should be investigated. With proper shielding and with proper ceiling treatment filament lamps are very satisfactory. The choice between installing fluorescent hot or cold cathode and filament lamps depends on many factors in a particular community; the money available for installation and for operating costs and the total room environment including its fenestration, interior decoration, general design and purpose must all be considered.

The amount of light necessary at ordinary work levels is debatable. Some scientific opinion to date seems to indicate that high levels of light quantity for reading are not necessary for those whose eyes are healthy; it also indicates that there is still inconclusive evidence as to the definite amount of illumination necessary for optimal reading conditions.¹ Literature in the field of education leans toward the criteria of the American Standards Association (see bibliography).

As long as the environment in the regular classroom is balanced as to brightness, the fenestration and artificial lighting systems probably should, under the most unfavorable outside lighting conditions, maintain a minimum intensity of light between 20 and 30 foot candles at ordinary work levels. In sight-saving rooms and in other rooms requiring detailed eye-work, the level should be raised; where critical eye work is not required, it should be lowered. The type of lighting and amount of light required in a room used for sewing, will of necessity be quite different from that required in an auditorium.

LIGHTING INTENSITIES RECOMMENDED BY THE ILLUMINATING ENGINEERING SOCIETY²

Area	Footcandles maintained in service
Classrooms, including libraries, shops, lecture rooms, and laboratories	30
Sightsaving classrooms, drafting rooms, and sewing rooms.....	50
Gymnasiums and swimming pools.....	20
Auditoriums, cafeterias, and similar rooms not used for study...	10
Reception rooms, locker rooms, washrooms, stairways, and corridors containing lockers.....	10
Corridors and storerooms.....	5

Eye comfort is seemingly dependent upon reducing the ratio of the light reflecting qualities of the *total* environment, not only those qualities in the immediate vision field but those in the surrounding ones as well. Highly polished chalkboards, bulletin boards and walls are as guilty of producing eye discomfort as are highly glossed work materials and desk tops. Brightness contrasts need to be reduced and low brightness areas raised whether the lighting system selected is indirect, semi-indirect, general diffuse, semi-direct or direct. *The type of system selected will depend on the type of work to be done in the room.*

Classroom lighting is affected greatly by interior decoration as well as by fenestration and artificial illumination. Glares and shadows can be minimized by the use of dull finishes throughout the room. Low brightness areas can be raised by reducing the amount of light absorbed

¹ Carmichael and Dearborn. *Reading and Visual Fatigue*. Houghton Mifflin Company, 1947. pp. 130-145, 347-357.

² American Standards Association, Inc. *American Standard Practice for School Lighting*. Sponsors: Illuminating Engineering Society and American Institute of Architects. September 20, 1948, p. 14.

by dark furniture, floors, woodwork, and so on. Colors and combinations of colors have definite effects on the energies of people. The adjustments required by eyes in meeting differences in brightness values and in sharp color contrasts as well as the adjustments required of the body in its effort to avoid glares from glossy surfaces are important factors to consider from the standpoint of fatigue. The trend in interior decoration is toward light colors and matte finishes, not only for walls and ceilings but for chalkboards, furniture, equipment and floors as well.

"Recommended reflection factors for ceilings are 80 to 85 per cent and for walls 50 to 60 per cent. Pastel colors are permissible, provided these reflection factors are used. Desks and table tops should be matte finish, light in color and between 35 and 50 per cent reflection factor. Floors should be light (15 to 30 per cent) and suitable for maintenance procedures which avoid darkening. Consideration should be given to the covering of dark chalkboards with light colored shades or panels when the boards are not in use or to the use of light colored chalkboards to improve brightness ratios."¹ The selection of colors and hues depends on the purpose for which the room is used, on the size and shape of the room and on the natural and artificial lighting arrangements in the room. Specialists should again be consulted.

Corridors, stairways, washrooms, locker rooms and so on, require less light than rooms in which concentrated eye work is required but they do require sufficient light to permit the conduct of activities efficiently and safely. Here too, proper fenestration and the use of light colors for decoration will aid tremendously in solving the lighting problem of these areas.

INSECT CONTROL

The necessity of school-room screening has not received the proper amount of consideration from the standpoint of nuisance or discomfort values or from the viewpoint of disease control. In regard to discomfort and nuisance, a particular school located near a county fair ground was almost uninhabitable for several weeks at the opening of school due to a concentration of insects resulting from an accumulation of filth, manure and refuse left on the grounds when the fair was over. It was not until the appearance of the first frost that the situation was eased. Screens on the school room windows and doors would have greatly relieved this condition.

Any abundance of flies in and around a school house is usually considered evidence of carelessness on the part of the school officials in permitting the existence of breeding places, such as exposed privy vaults or open garbage and rubbish heaps. It is known, of course, that flies are attracted to school rooms when food is present. It has been well established that flies may be vectors of organisms causing communicable diseases such as typhoid fever and dysentery.

In a simple experiment which was conducted several years ago, lime was deposited in a privy vault near a restaurant; subsequently the white lime was observed on the flies at an eating table in the restaurant.

¹ American Standards Association, Inc. *American Standard Practice for School Lighting*. Sponsors: Illuminating Engineering Society and American Institute of Architects. September 20, 1948, p. 14.

In another instance, following the investigation of a typhoid outbreak, it was found that flies were evidently responsible for transmission of the typhoid bacillus from the fecal matter from a temporary privy used by several workmen during a new construction job. One of these workers was found to be a carrier, and one of the persons infected died from typhoid fever.

Not to be overlooked, of course, is the possibility that flies may be vectors in connection with poliomyelitis and many other diseases.

In view of the known dangers, it would be folly to say that flies should not be kept from school rooms. On the basis of their nuisance ability alone, however, all flies should be eliminated. Not forgotten are the days in the school rooms when certain of the pupils used to compete to see how many flies could be stored in the ink well.

Although screening of school buildings is recommended it is neither required nor are schools penalized for not having adequate screening.

The elimination of breeding places at and near schools is fundamental. Privies and septic toilets should be of flytight construction and no garbage or fly-breeding rubbish should be permitted to linger on the school premises. Protection of the children when playing outside is just as necessary as when studying inside.

The preparation and handling of food requires special consideration in regard to protection against flies. If a school board operates a school kitchen and/or lunch room for the children, these rooms should be screened during the fly season. Certainly, if the school is located near some fly-breeding area that can not be held in check, the school board should provide screening for the school. Usually, 16 meshes per inch is considered a satisfactory type. Screening should be practiced in conjunction with a *complete insect control program, including residual-insecticide spraying.*

The development of new residual insecticides such as DDT and Chlordane add to fly control methods and make fly control more complete. Proper sanitation plus effective fly screens are still the main fly control methods. These should be supplemented with residual insecticides but insecticides should not be used as a substitute for sanitation and good sanitary practice.

At this time, the commercially obtainable DDT insecticide spray having a strength of 5% is probably the most practical product available for use. If properly applied first before the fall school season opens, the lasting effects of this insecticide will give excellent results. In general, it need not be applied to give complete coverage of all surfaces but rather should be sprayed on only those surfaces that attract the flies. These include the window and door frames, corridors complete, and the ceilings and light fixtures of the school rooms. School-room basements should be sprayed thoroughly. As the fall season begins, flies are particularly attracted to the warmer surfaces, so ceiling spraying is very important. Special precautions must be taken to cover food, dishes, and food-handling equipment to prevent insecticides from falling on them during spraying operations.

Only one application should be necessary, as the DDT residual action persists for many weeks and sometimes months. It is necessary to apply

the spray evenly so a pressure hand sprayer should be used. Since the fall application should be sufficient in most cases, school boards may find it advisable to have the spraying done by an outsider experienced in this work. In general, the 5% solution is applied to give an application of one pint of mix to 120 square feet.

Ants, cockroaches and other insects may be a problem in some schools; usually mosquitoes are not a problem in connection with the protection of school children because the Illinois varieties do not ordinarily bite during the daytime. The residual spray will assist in controlling them if they cause some nuisance.

Certain advantages would be obtained by school room screening, but greater comfort and safety will result from a combination of screening and the use of known insecticides as a part of a complete insect control program.

ACOUSTICS

The ability of a student with normal hearing to grasp or interpret the instruction directed to him through the medium of sound is influenced largely by the acoustical conditions of the enclosed space through which sound travels to his ears. If the original sound is marred by excessive reverberation, echo or noise, it becomes difficult for the student to reap the benefits intended for him. With the comprehensive acoustical information and expert technical assistance available to the school authorities and architect, good acoustics can be assured in every school today. The acoustical problem as it relates to schools may be divided into two general classifications:

Planning for the elimination or control of extraneous noise originating at sources either outside or inside the building.

Planning for the best possible hearing conditions in rooms where the intelligibility and naturalness of speech and the quality of music are primary considerations.

The effect of extraneous noise is twofold. It produces a masking effect which makes it difficult for a speaker to be heard unless he raises his voice to overcome the interference; and it makes mental concentration difficult for the student. Attempting to concentrate in the presence of extraneous noise means unnecessary expending of nervous energy. The effort involved is detrimental to both the mental and the physical well-being of the student.

Acoustical materials, applied to the walls or ceilings of rooms to reduce extraneous noise or to control reverberation, vary considerably in their absorption of sound at different frequencies. Many of these materials are selective in absorption; that is, they absorb sound to a much greater extent at some frequencies than they do at others. In order to avoid impairing their effectiveness, care must be exercised in the matter of painting or other treatment of these materials and in the matter of controlling sound seepage. Particular care must be exercised in the selection of acoustical materials for pools because of the problem of moisture.

The ideal acoustical material for noise reduction work, as well as for the acoustical correction of many listening rooms, would be one which absorbed sound nearly equally at the low, middle and high range

frequencies. Materials are available which have practically uniform sound-absorption characteristics but many of them are costly and involve special methods of application. From the practical viewpoint, therefore, it is often necessary in the treatment of such spaces as corridors, rooms used for office machines and mechanical arts, the cafeteria and kitchen, and the gymnasium and pool, to use materials having their maximum absorption at the particular frequency regions of the noise produced in those spaces. The use of materials having very little sound absorption at the low frequencies should be avoided.

In rooms where the intelligibility and naturalness of speech and the tonal quality of music are primarily functions of their use, consideration should be given to the shape of the room and to the proper selection and distribution of sound absorbing materials with respect to shape and to the various uses for which the room is intended.

It is always advisable to consult those who have made a study of the subject of acoustics before definite plans are made for treatment of either new or old buildings. Educators recommend acoustical treatment for all instruction spaces, corridors, lunchrooms and places of assemblage.

SEATING

There was a time when the classroom was a place where children sat quietly in their seats all day and listened to the teacher or read from their books. Today the classroom more nearly resembles a workshop in which the pupil-teacher relationships are constantly being changed. A part of the day may be given to construction work where the racket of saws and hammers shatters the traditional hush of the school atmosphere. After the cleanup period, the classroom may become the scene of a conference. Problems may be discussed and suggestions for improvements made. Plans will be formulated and assignments given to groups and individuals. The next scene may be that of a reference library. Some groups will be writing, others will be searching for new material and some will be conferring with the teacher. Again the scene may shift and we may find pupils studying arithmetic, spelling, history or formal grammar. At the end of this period the shades may be lowered and lantern slides, film strips, or a movie may be shown.

When we consider these changes in a classroom, we realize that the furniture for a modern classroom must be chosen with the greatest of care. It must be designed to this active and dynamic program of education.

A better understanding of the needs of pupils has brought about a fundamental change in the instructional program of the modern school. School buildings and school equipment must be redesigned to serve this new program. Housekeeping becomes a complicated problem for the teacher. He is asking for more storage space, special work areas, increased floor space and more flexible seating as he attempts to implement the new program.

As the administrator sets out to buy new seating equipment for his classroom he must consider a number of variable factors. For ex-

ample, there should be a station for each pupil. This item is unquestionably greater than most people realize. This station must provide the pupil with a seat, an adequate work area and storage space for writing implements, notebooks and books.

There are certain health factors that must be considered in selecting seats for all respective age groups. The seats must be fitted to them. This is a complex problem because children are not uniform in growth rates. Each room must have seats and desks of varying sizes but size is not the only factor. The seats should be comfortable. If the seat conforms to the anatomy of the pupil, it must be at such a height as to allow his feet to rest on the floor without raising the leg from the front of the seat. The back must provide a firm support for the spine above the upper margin of the pelvis and below the shoulder blade, leaving the balance of the spine free. It should be possible to sit in the seat in a number of ways while carrying on different activities. Adequate seating will provide adjustable work surfaces as well as adjustable chair heights. It will also provide for adjustments to lighting particularly in cases of left-handedness. Fortunately, many manufacturing companies have given some consideration to health factors regarding seating.

Chairs should be equipped with rubber glides. These glides will reduce the noise in the classroom. The equipment should be of sturdy construction. The center of gravity should be low so that the chair does not tip over easily. The needs of the pupils and the program of classroom instruction should dominate in the selection of classroom seating. Today's classroom should be attractive, homelike and pleasing. The equipment must fit harmoniously into these colorful rooms so as to create an environment that is both satisfying and effective. There needs to be a clear recognition of the influence of classroom environment on pupil growth.

The effectiveness of a given classroom seat can only be evaluated in terms of the type of program conducted in the classroom. Special furniture has been designed for the laboratory, the cooking room, the art room, and so on. The modern school offers many opportunities to work with many resource materials; a comfortable chair and a place to rest a book or other materials are necessities. Many times, however, the pupil will want to take notes or compute problems; consequently, a work surface will be required. Some of the activities carried on in the classroom will require a special type of furniture; the selection of furniture will be determined by the type of activity.

There is another trend in modern education that requires special study when new furniture is being selected and that is the tendency to do more and more work in small groups. Discussion groups, committee assignments, special reports, small group projects and kindred activities place a new demand for light, flexible furniture which can be contracted or expanded to fit the group. Rigid and heavy furniture is a real block to classroom activities.

The modern school program is so varied in its activities and needs that no equipment will be entirely satisfactory. The school administrator who attempts to evaluate school furniture in terms of a modern program will find that he has a difficult task. As he studies each type

from the standpoint of effectiveness, he will probably place the old-fashioned combination desks at the bottom of the scale. The pedestal desks are a variation of the combination desks and have the advantage of being adjustable for height and of making sweeping easier. Movable combination desk seats will be ranked above many of the old type desks. They are usually adjustable for height, are movable and so have a degree of flexibility that is in demand in the modern classroom. They do not combine well to form large work surfaces and they usually have sloping tops so that their usefulness is limited to the reading and writing type of activities. However, seats of this type which have adjustable tops have the advantage of providing flat surfaces as well as sloping surfaces; from a visual standpoint sloping surfaces are more advantageous for most school room tasks. Tablet arm chairs have a usefulness which is limited to the bookish activities. Chair desks, which are but overgrown tablet arm chairs, are not much better although the added work surface is a desirable feature.

Individual student tables and chairs will be the final decision for some educators. They are the ultimate in flexibility. They combine well to form large work areas. They give a pleasing pattern to room arrangement and so have much less of the institutional look. They have their drawbacks, however, for they clutter up the room with a vast number of legs. Their small base makes them somewhat unstable. They have many corners to hit and many legs to stumble over. To avoid some of these disadvantages, larger tables are available, built to accommodate two, three or six pupils. The tables which seat two or three pupils to a side materially reduce the number of table legs, they are cheaper per pupil unit and they have greater stability. In all probability table type equipment is being chosen more frequently by teachers and administrators who are carrying on a modern school program. However, tables introduce a new problem; they crowd the pupils. With tables that seat four or six pupils, crowding is greater, some pupils must face the light, some pupils will not fit the table, and pupils must face each other at close range. During work and study periods, this can be a real drawback. Some feel that it is more difficult to adjust working groups to the large tables.

There is still much room for improvement in school seating and the need for experimentation is still evident. In conclusion, it might be said that what is new in school seating is the demand for furniture that is more effective in carrying out the programs of the modern school, furniture which is most harmonious in color and form to create a more homelike environment, and furniture which is functional from the standpoint of the needs of the growing child or adolescent.

FLOORS

The finished floors in classrooms, laboratories, administration rooms, household arts and similar rooms may be of asphalt, wood, or linoleum. Cork or linoleum tile may be used except in laboratories. In household arts, kitchen, and so on, the tile should be a grease-resistant type. For corridors and vestibules floors may be of terrazzo, asphalt tile or linoleum tile. Non-slip terrazzo is suitable for stair treads. Hardened and properly sealed cement floors may be used in auditoriums, boiler

rooms, fuel rooms, engine rooms, shops, storerooms and utility closets. Wood floors are definitely superior for gymnasiums. Aisles of auditoriums should have a covering over the concrete. Non-slip tile or terrazzo is definitely superior for locker rooms, shower rooms, toilets, washrooms and swimming pools.

CORRIDORS AND STAIRS

Corridors need to be constructed of noise absorbing materials backed up by impervious surfaces so far as the treatment of walls and ceilings is concerned. Student traffic should be studied carefully and corridors provided to facilitate ease of circulation and prevention of traffic jams. Whenever the curriculum is departmentalized, extra care should be taken in planning classroom location and corridor layouts. Ramps, approaches to stairways, the stairways themselves, and the treads and landings should have "non-skid" floor surfaces; hand-rails should be provided for all lines of traffic. Where it is felt necessary to provide for handicapped children, at least one ramp should be built at one of the entrances. If corridors are used to house student lockers, extra width should be provided. "Built-in" lockers are cleaner and more attractive than free-standing lockers. Corridor gates are employed so that access can be limited to certain areas of the building on special occasions. Care should be taken to provide adequate light for corridors, either natural or artificial. If the corridor has classrooms on both sides, some natural light can be obtained by using translucent glass panels in classroom doors. Special study should be made of lighting where corridor floor levels are interrupted.

HARDWARE

Fittings should be of non-corrosive, durable materials and all openings, such as doors, should be provided with necessary hinges, locks, closers, and so on. Mechanical devices for exit doors should be of the best quality. Door closers, on exterior doors should be provided with holder arms; they should also be used on interior doors in connection with the gymnasium, pool, locker rooms, and so on. Locks should be master keyed. Particular care should be taken in the selection and installation of all hardware from an accident prevention point of view.

AUDIO-VISUAL AIDS AND PUBLIC ADDRESS SYSTEMS

Probably no phase of curriculum improvement is so dependent upon building facilities as the audio-visual program. Especially do we find this true with projected teaching materials. Obviously we are concerned with two aspects of the building problem, that of adapting existing buildings to modern techniques, and that of providing desirable facilities in new construction. A bilateral treatment of these two general problems will be made with respect to the most common desirable room and plant characteristics.

Buildings and rooms should be provided with ample bulletin board space. Slate or chalkboard facilities are very necessary in all grade and most secondary school departments. Bulletin boards should be functional and placed at eye level rather than as borders above chalkboards.

Electrical facilities are quite important. Old buildings rarely are provided with the necessary outlets. In planning new buildings these outlets should be placed on each of the four sides of the room and older buildings should be wired to provide for outlets at least at the front and rear.

While darkening facilities are becoming less a necessity with modern projection equipment, some consideration should be given to this feature of rooms. There is no one answer to the question commonly asked, "Should we equip one room for projection purposes or plan to use films, slides, etc., in classrooms?" Two considerations should be kept in mind. Audio-visual materials best serve their purpose when used in actual classrooms, with the least possible mechanical and physical interruption to the educational program continuity. It is equally true that, in some instances, physical building and equipment limitations prevent efficient use of materials in the classroom. It is a function of the administrator of this program to determine the best plan to follow considering the local possibilities.

Adequate ventilation is always essential. If the air circulation system does not allow for a continual change of air during the use of shades in the classroom or the projection room, a light trap should be constructed to allow for ventilation.

Rooms vary considerably in acoustical qualities. Briefly, large hard surfaces should be covered or shielded from direct sound. Usually the ceiling is the chief offender and a covering of acoustical blocks will improve the condition satisfactorily. Experimentation with speaker placement often results in improved sound with educational films.

The use of the radio as a receiver invites the same considerations as the sound projector; however, provision for an acoustically efficient room will allow for better recordings in music and speech and also provide for facilities from which the school may feed radio programs to a local station if one exists.

The entrance of television into the educational field is only a matter of a short time. Already public informational programs are being televised and schools will eventually accept television as an indispensable medium for mass communication. In the light of these facts, new buildings should allow for antenna transmission lines of the proper impedance to be channeled to all rooms. Undoubtedly these installations should be made to assemblies and several selected rooms at the time of building construction.

Public address systems are of considerable value in larger school buildings. These should have two-way communications, and if used for inter-communication, should be designed to contact a classroom without interrupting the entire class. If two-way systems are used, classroom outlets should signal clearly when switched on the system. Public address systems are particularly desirable in buildings where the enrollment is too large for regular student general assembly. Public address systems should be controlled from the office suite, and if the school has a broadcasting room, a second control panel should be located there. A portable control panel will be needed in connection with the auditorium and gymnasium and conduits should be so provided.

GENERAL MAINTENANCE

Oil and gas fuel cut down maintenance work. If coal is used, provision should be made for bin feed and cinder ejector belts. If possible, the fuel storage area should be designed to store a year's supply. Heating units should drain separately and without stopping the furnace.

The main building utility control panels should be located in the janitor's room. The night light switch should probably be in this area. The janitor needs filing facilities and blue print storage trays. He needs a shop with tools to do some construction work, and some simple plumbing, electrical, furniture and other repair work. It is desirable to have a receiving and supply storage room centrally located and easily accessible. Conveniently located small supply depots and slop sinks with ample storage space for maintenance equipment will facilitate the work of the maintenance staff. Vacuum systems are now available which will work and will greatly increase the thoroughness of sweeping and mopping operations. Refuse chutes should be placed at various points throughout the building with a central dumping point. Garbage disposal units and incinerators should be provided near points where they are needed. Provision should be made to carry incinerator fumes up the main stack.

Janitors are important people in the school. The thoroughness of their work influences factors of health, safety and pleasantness of environment. They should be thoroughly indoctrinated in the proper use of disinfectants, and control of heat and ventilation and be assigned to reasonable hours of work on a regular schedule of routine cleaning and scrubbing. Janitors should be encouraged to study the psychology of getting along with children. They should be career men, picked early in life because they are good workmen and are interested in being a maintenance worker. They should be given opportunity for continuous training and growth in their field.

Chapter IV

CLASSROOM FACILITIES

GENERAL

In contemporary schools almost every classroom is, in a sense, a library and this premise should be considered in classroom planning. Schools at the elementary level may require some specialized rooms; however, the majority of the rooms will be planned for the conduct of an ever-changing classroom scene. They must be flexible and arranged for easy expansion. Movable furniture and ample storage and work space should be provided. Many of the features of secondary school classrooms are applicable.

If the 7th and 8th grades are in the elementary school, facilities should be provided for an enriched program to include industrial arts, homemaking, science, music, art and physical education. In the first six grades special rooms will probably not be necessary except for physical education and kindergarten.

The kindergarten unit should be on the first floor and located for the morning sun. It should be homelike and attractive and have a direct exit to an outdoor play area. A private toilet room is necessary; a kitchenette and a rest room for naps are desirable.

In secondary schools, where departmentalization is necessary, many rooms will be designed for specific purposes. Classes emphasizing the reading skill should be provided with ample library facilities, and be grouped in the central library area. Storage and display requirements should be foreseen. Conference rooms should be adjacent, and these rooms should be equipped with movable individual tables suitable for group work. Many mathematics teachers still like to emphasize ample blackboard space. Provision should also be made for lavatories, instructor's personal belongings, storage of teaching supplies, handling of current issues of periodicals, and audio-visual aids with projection screens and numerous electric outlets. Classrooms need acoustical treatment to provide maximum control of voice factors. Color schemes should avoid distracting contrasts. Surfaces should reflect only diffused light. Acoustics, colors and reflection factors require the guidance of experts. Suggestions regarding them have already been discussed.

SCIENCE

Science rooms need certain special treatment in application to the specific type of science which they are to house. Greatest internal flexibility is achieved by a design incorporating around-the-wall work ledges equipped with sinks, gas outlets and electrical outlets. Interior ledges will need artificial illumination. With this type of arrangement, movable single tables can be used for classroom seating. These can be maneuvered into additional laboratory work space, or for group work, or the chairs may be grouped around the instructor for discussion. Other facilities include provision for demonstration and audio-visual equip-

ment. Here too, there is an increasing demand for ample library shelving and cases or racks for periodicals. In some science rooms, special ventilation is required for the removal of obnoxious odors and gases. All surfaces used for experimentation will need chemical resistant tops. Soil lines, sinks, and floors will need similar treatment. Special attention must be given to chemical and equipment storage in accessible store rooms which can be locked. A "greenhouse" area should be located in or adjacent to the biology room. In connection with physics, there will need to be a dark room. Also in the science suites, there should be a small "experimental" room, where special experiments can be carried on by small groups. Handy, too, is a storage room large enough to set up experimental materials preparatory to class use. Adequate and appropriate first aid stations, supplied with special first aid materials to treat mishaps arising from the use of chemicals, must be provided in science suites.

ART

In all but the largest schools, art rooms should probably be designed for commercial and other types of art and for art appreciation. North exposure is desired, and a location near the shop may be desirable. In the case of a combination room, a smaller project room is recommended adjoining the art classroom. Drawing tables and work tables are basic equipment. The rooms need large bulletin boards, a display counter, a display case on the corridor side, project storage, easels, stands for models, a variety of files, shelves and poster trays, sinks, kiln, electric outlets, gas lines and hot and cold water. Lighting in this room should be studied carefully for fullest illumination and control of natural light.

MUSIC

Music departments should be sound proofed from the rest of the building and acoustically treated internally. It is desirable to have them near areas where public appearances will be made. This department is often used at night and should be so located as to permit its use without opening the rest of the building. The rehearsal room may house band, orchestra and chorus; it should be large and have a high ceiling and a terraced floor. A classroom should be provided for group instruction and music appreciation, both formal and informal. Small practice rooms are needed for individual and small group practice. Provision should be made to house a music library and cabinets need to be provided for uniforms and instrument storage. An office can usually be arranged in connection with the music library. Also needed is some arrangement for cloak space. A broadcasting room may be provided in the music suite if there is a radio station in the community.

VOCATIONAL

HOMEMAKING

The most desirable arrangement for the one-teacher homemaking department is one large room in which there is a foods center, a clothing center and a home living center. In a two- or three-teacher department a foods room and a clothing room will be separated by a small

apartment. The latter may consist of a combination living and dining room, a bedroom or bed closet and a powder room with a shower and first aid cabinet. Each room should be equipped for teaching at least one major and one minor area of homemaking, such as: Foods and consumer education; clothing and related art; home management and child care. Where there are three or more teachers in the department, it is not uncommon to add an additional multiple-purpose room or workshop. This provides a place where small groups or individuals may work in the various fields of homemaking when the special rooms are in use. The homemaking room or suite should be sufficiently flexible to permit versatility in teaching the different areas of homemaking to various age groups, including adults, also it should allow for the conduct of special teas and group meetings. Adequate storage space should be provided in all of the centers. Class discussions will take place around tables in the laboratories or centers.

The foods equipment, whether in a separate room or in a part of a composite room, will be set up in the form of unit kitchens, each to accommodate a "Family" of four to six pupils. Necessary refrigeration, sanitary towel drying devices, laundry and waste food disposal units should be provided. Attention should be given to insulation against the transmission of noise and food odors.

The clothing area should be equipped with sewing machines and four-pupil work tables. Adjacent to the clothing area will be a fitting room with a triple full-length mirror; or these mirrors may be on the cabinet doors in the clothing room and surrounded by a folding screen when they are in use. There should be a tote tray for each student with tote tray cabinets; also receptacles for tote trays in the clothing work tables where they may be placed when the pupils are at work. The compact storage cabinet will include space for ironing boards and irons. There should be adequate electrical outlets.

Junior high school homemaking departments are equipped in much the same pattern as senior high schools except for heights of working surfaces; these will be lower. With the assistance of the homemaking teacher, the regular classroom teachers will add homemaking units to their work in the first six grades. Much of this is done in their own classrooms; however, there are occasions when these pupils may go to the homemaking department for their classroom activities.

AGRICULTURE

This department requires a combination discussion and laboratory room, a shop, a storage room and an office. The classroom should be large, with under-the-window work ledges, storage cabinets, shelves, and sinks. Movable tables and chairs for flexible groupings are needed for class work. The shop should be large enough to receive several farm machines at one time. Student work benches should be provided around the wall. Lumber and metal storage racks are often an open framework in the shop. A shed may extend over the exit to provide additional storage space for farm machines and large projects; an outdoor parking area may also be necessary. Be sure the shop door is of proper height and width and if possible have exit doors in two ends of the

shop. Also, the office should have glass partitions opening onto both the classroom and the shop. Lockers for shop clothing and ample lavatory facilities must be planned. Agriculture areas are active areas and attention should be paid to noise factors, fumes and dust.

SHOPS FOR TRADE, INDUSTRIAL AND INDUSTRIAL ARTS EDUCATION

Most communities need general shop facilities as well as unit shops for auto mechanics, woodworking, metal working and welding, electricity, drafting and graphic arts. These basic functions lead to many specialized crafts. Because of changing economic demands and student needs, this area must be the acme of flexibility. Areas devoted to certain skills will change from year to year. Partition walls, as well as adequate lighting and power outlets, should be provided in sufficient quantity to permit moving machines to various locations. A planning room, also housing a library, will be needed and if possible, should be between the shop and drafting room with glass partitions in both directions. Exhaust systems should control fumes from welding, forgework, motors, and dust-creating machinery and activities. Glass partitions should be employed where one teacher supervises more than one area. Dustproof finishing rooms are needed if cabinet work is emphasized. Finishing rooms should have glazed surfaces and floor drains. Tool panels are satisfactory for small tools. Discussion areas may be provided by using folding bleachers. Wash rooms and locker rooms should be adjacent. Circular lavatories are suitable where large numbers need to wash at one time. The locker system should afford space for individual project storage. Also needed are storage rooms for equipment not in use and for excess materials. Lumber and metal storage racks should be easily accessible for loading and unloading as well as for student use. Adequate space must be allowed to operate machinery safely. Electricity, water, drainage and ventilation must be studied closely in connection with each area. The drafting area should be isolated from the remainder of the shop, and the whole shop area insulated from the rest of the school plant. Doors, again, are to be amply high and wide and should enter onto main service drives.

Due to extra wide ceiling spans often used in agriculture and industrial education shops, extra care must be taken to provide adequate light. Special lighting problems are encountered in connection with the use of machines. Most school shops are planned to make maximum use of natural light, but provide artificial light so as to insure safe operation of tools at all times. Safety code colors for machines are desirable.

Adequate spacing of machines and work areas is probably the largest single safety factor to be considered in shop planning. Liberal use of painted safety zones to prohibit traffic from crossing work areas will help. Non-slip mats should be used where machine operators will encounter slippery floor conditions. First aid stations should provide equipment for the removal of foreign objects, tourniquets and first aid for burns, as well as all standard supplies, if use of same is permissible. Stations should be checked daily to insure full stocks of supplies; they should also be kept clear of refuse and unused materials.

BUSINESS EDUCATION

Educational facilities in this area traditionally include bookkeeping, shorthand, typing, office training, consumer education, retailing and other business education courses. Departments looking to the future will need to give these basic skills and learning areas a distinctive vocational emphasis in a more inclusive program, providing for part time on-the-job training as the student reaches the period immediately preceding entrance into full time employment. Typing, bookkeeping and shorthand rooms are business laboratories where a variety of machine skills are learned, the variety depending on the means and needs of the community and the needs of the students. Rooms for office training should be equipped with the facilities the trainee would expect to find on the job. These rooms may also be used as student publication or community production rooms and may include a few extra pupil stations for typing practice to be used by students in their free periods. Drop-head desks for all typing rooms increase the flexibility of the rooms. If individual tables are used in bookkeeping rooms, these rooms can be used for other business classes.

If the department is large enough, a "distributive education" room should be provided for related training for advanced students doing part time work on the job. This room should have display windows opening onto the corridor, display cases, counters, fountain counter, shelves, cabinets and triple mirrors. One area in the room should be designed for a conference-instruction area equipped with movable tables. This room should have an office nook, or be combined with the office training room, or adjacent to it, and in that event have a glass partition separating the two.

Business education rooms need to be spacious. Tote trays may be used for storage of student supplies and, in case this means is used, tote tray cabinets should be provided. Work ledges around the walls afford extra work space and space for machines; cabinets underneath workledges make valuable storage space. Lavatories should be provided in connection with rooms housing machines and vocational activities. Floor outlets are needed as well as wall outlets for electrical appliances and machines. The business education suite is a noise-producing suite and attention should be paid to its location and insulation.

SPECIAL EDUCATION

The majority of the handicapped children who are able to go to school will attend either regular or special classes in a regular school building. Consequently, those who are responsible for the planning of school buildings should be aware of the needs of handicapped children.

In order to facilitate getting physically handicapped children in and out of a building it is suggested that at least one door at one entrance be equipped with a ramp instead of steps. In multistory buildings consideration should be given to the advisability of having a ramp from one floor to the other floors or of providing an elevator. Hand rails along the walls as well as on the stairways should, also, be provided. Very often it is physically advantageous for a handicapped child to make the effort of climbing stairs but the hazard of doing so without the protection of hand

rails is rather great. The slippery floor surfaces and finishes should be avoided. In large school systems it is recommended that one or more buildings, depending on the need, be equipped in these ways so that the children who need special facilities can be transported to a particular building.

If there is a sufficient number of handicapped children to warrant providing special classroom facilities, these rooms should be equipped and arranged so that an educational program which is adjusted to the children's needs and their handicapping condition can be conducted in them. Particular attention should be given to types and arrangements of furniture, lighting, acoustics and toilet and hand washing facilities.

Storage cabinets which are recessed in walls and wide aisles will minimize the hazards to those pupils who need to use wheelchairs, crutches or braces. Very often special types of seats, desks and work tables will be required. Children having critically defective vision will need particularly good lighting arrangements and light intensities at work levels. The acoustical details of all school buildings are especially important to handicapped children. Generally, the fact that these children are handicapped increases their nervous tension, so that they are more sensitive to noise than so-called normal children. Rooms for speech correction and for acoustically handicapped pupils require the use of sound absorbing materials in the floors, walls and ceilings.

The judgment of educators in regard to buildings and rooms for handicapped can well be tempered by the philosophy that a handicapped child needs facilities which will enable him to work in an environment which is adjusted to his particular needs, abilities and disabilities. Such a child has a handicapping condition with him at all times. Inadequate facilities only increase the handicap and decrease the possibility of successful adjustment. Those who are planning rooms for handicapped children should consult with the specialists in the Division for Exceptional Children, Office of Superintendent of Public Instruction, 401 Centennial Building, Springfield, Illinois.

Chapter V

OTHER FACILITIES

ADMINISTRATIVE

The office suite should be designed to handle a central records system; this implies ample space for stenographers and administrative assistants and for filing, work tables, duplicating facilities, bookshelves and counters. It should be centrally located, with exit apart from public spaces. Public waiting space should be well-equipped with seats, telephone, a bulletin board and clock space and provision for faculty mail, package and memo distribution. The public space is usually separated from the main office by a counter-height partition upon which is writing space. In office suites it has often been found that glass partitions at average shoulder height can be used to advantage. The record vault should be fire-proof and of sufficient size to receive live and mobile record units. Provision for inactive records should be made nearby. The office suite also houses the master clock and bell system, public address control compartment or panel, conference cubicles, principal's private office and board room. The board room may also be designed as additional work space and conference space. Be sure to include a chalkboard, bulletin board and visual aid outlets. Toilets, washrooms and cloakrooms should be provided.

Often, guidance suites are adjacent to or combined with the office suite and consists of flexibly arranged classrooms and conference rooms. The bookstore, student store and "lost and found" department are adjacent, unless it is deemed advisable to have the bookstore controlled by the librarian.

TEACHER SERVICE

Provision should be made for at least one room for each sex, with toilet and washroom; also, a clock, lounge and work facilities should be included. In departmentally organized schools, teachers are often assigned to different classrooms during the day, or do not teach every period of the school day. In this event, office-conference rooms for teachers are necessary. These need office areas and conference equipment for use in working with small groups.

STUDENT SERVICE

The student store should be easily accessible to students and have proper location for ease of delivery of supplies. Exterior windows are desirable and there should be a sales window. Walls should have adjustable shelving of various widths, as well as drawers and cabinets which can be locked.

A student publication room should be located close to the English or Commerce classrooms. It should be amply equipped with work tables, filing equipment, shelving, typewriters and duplicating space. Glass par-

titions at shoulder height are recommended in the direction of the room from which the major portion of faculty supervision is to come.

STUDY HALL

Study halls should be located near the library and should be equipped with individual tables and book shelves, and treated for a quiet and pleasant atmosphere. The design should encourage supervised study and guidance in small, flexible units. Particularly in smaller schools, combination library-study halls are considered successful. In any event, study hall location and arrangement should provide easy access to reference materials.

LIBRARY

The library should be in a quiet zone which is centrally located and close to study halls or home rooms and remedial reading rooms. Its facilities include a charging desk, adjustable open shelves, devices for the display and storage of periodicals, space for audio-visual materials, and cases which can be locked; a reading room, browsing nook, stack room, work room and an office-conference room are also desirable. Visual aids libraries are often administered by the librarian. Care should be used not to block the future expansion of the library by structural limitations. Natural light can usually be obtained on three sides by proper planning. In the library suite some provision should be made for filing large posters which are to have intermittent future use.

COMMUNITY ROOM

Community rooms need to be easily accessible to the public and provided with exits direct to the outside. They should be very flexible so as to accommodate groups of different sizes and purposes. Movable chairs are desirable. A small kitchen should be provided, as well as cloak space, toilets and a small stage. Provision should be made for audio-visual equipment, as this will be a part of the program of many group meetings.

AUDITORIUM

As in other phases of school planning, the varied functions of the auditorium must be determined. The size will depend on school and community needs and use and on the other facilities available.

The auditorium should be on the ground floor and easily accessible from the outside without going through other parts of the building. A lobby is needed at the main entrance. There should be exits to the outside; feeder corridors should be arranged along the two long sides of the room.

The main floor should slope toward the stage; there may be ramps to the stage as well as to other floor levels of the auditorium. Balconies are not particularly desirable unless needed for seating space; these have stepped floors.

A type of fixed seating which is staggered so that seats in one row are not directly behind those of the row in front is preferable. There should be a comfortable amount of space between the rows and seats

should be wide enough to accommodate adults as well as children. Aisles with seats on both sides may be or may not be necessary; quick evacuation of the auditorium in times of emergency should be the guiding factor in determining the number and width of aisles as well as the number and width of exits.

Walls, ceilings and floors of auditoriums need special acoustical treatment. Decoration need not be ornate; neutral colors are desirable.

Since light control is a major problem, natural light is not paramount if adequate ventilation is provided; auditoriums are not suited to combination use as a study hall. Facilities should be provided for projection equipment and keyed houselight control switches.

The stage should be studied for ample depth and proscenium arch for adequate height and width. All sight lines should be carefully checked to permit full vision from all parts of the auditorium. The ceiling over the stage should be high enough to allow for scenery, screens and curtain hoist. Two dressing rooms should be provided with lavatories, toilets, theatrical mirrors and cloak closets. Dressing rooms should open directly onto the stage. Also needed nearby, is a room where stage properties can be erected and stored. The stage should be equipped with cyclorama and gridiron.

If the auditorium is housed in the gymnasium (although this is not recommended) stage facilities should be provided as for an auditorium. Combination gymnasium-assembly units should be acoustically treated. Care should be taken to provide easy storage and manipulation of auditorium chairs; placing them on trucks and storing them under the stage is sometimes advocated. If too much work is involved in arranging chairs for auditorium use of the gymnasium, the purpose is defeated.

LUNCHROOM, FOOD-HANDLING AND FOOD STORING

Food handling facilities are found in the cafeteria and the home-making department. It is unwise to combine these departments and their facilities. In locating the rooms, thought should be given to the problems of safety, student traffic, noise, odors, the convenience of getting supplies into the rooms and the disposal of waste materials. A ground-level location is desirable for cafeterias unless there is a freight elevator. Toilets and handwashing facilities should be conveniently located for the students and the employees.

Obviously the rooms should be adequate in size and arrangement. The doors and windows should be screened. The whole area should be clean and attractive. Light harmonious tints are recommended for the walls and cabinets. The walls should be washable. Wood floors, if used, should be sanded, sealed and waxed. However, waxed ceramic tile, terrazzo or linoleum are more satisfactory, since they are more nearly stain and grease proof. A special wax is recommended. The floors should be wet-mopped daily.

Provision should be made for adequate natural and artificial lighting. A minimum of ten foot-candles of properly diffused light is recommended for the dining room and twenty-five foot-candles for the kitchen. The ventilation system should provide for fresh air with the elimination of odors before getting into other parts of the building.

Simple drapes and other decorative effects may be used but care must be exercised to avoid having dust-catching objects.

Provision should be made for the proper storage of canned, dry and perishable foods. This calls for shelves, rodent free bins and containers and a refrigerator. Apple and potato bins should be constructed to allow for the circulation of air around them. Dishes and cooking utensils should be stored in clean, dry and sanitary places. Adequate provision should be made for washing, rinsing, sterilizing and drying dishes, silverware and utensils. It is recommended that the larger cafeterias have a dishwashing machine. The rinse water in the dishwashing machines should have a minimum temperature of 170° F. Dishes in school lunch-rooms not equipped with dishwashing machines should be rinsed in a chemical solution or in water having a temperature of at least 170° F. There should be an adequate and convenient supply of water with plenty of hot water. Drying racks for towels and cloths should be washed daily with soap and water and used for no other purpose. Frequent inspection of all food handling equipment methods and personnel is essential. Although epidemics of food poisoning seldom occur, every precaution should be taken to avoid them.

The cafeteria dining room and kitchen should be separated. The steam tables, counters and drinking fountains should be arranged to speed the serving line and avoid traffic congestion. It is best to serve hot food from steam tables. Plans may be made for the students to return their trays and dishes to a central point after they have finished eating.

The seating arrangement in the dining room should be orderly. The over-crowding of tables and over-crowded seating at table needs to be avoided.

It is recommended that table tops have an impervious finish that is easily cleaned with soap and water after each serving. Dressing rooms and lockers should be provided for personnel and those who handle food should be clean and free of disease as determined by thorough periodic examination. Students should wash their hands before eating and time should be allowed for this purpose. A minimum of thirty (30) minutes should be allowed for lunch periods and more time is desirable. A first aid kit should be located in the cafeteria.

Dining should not only nourish the body but should also provide a desirable social experience. Some schools provide for special small group meetings while dining.

This article merely calls attention to the most salient features in providing adequate sanitary facilities for food handling. We have avoided duplicating materials that are readily available. Those who wish to improve their program should consult the bibliography.

Chapter VI

TRANSPORTATION

Pupil transportation in Illinois is an integral part of the program of public instruction and it is not to be considered as a secondary facility which has been added merely for the convenience of the pupils transported. Poor road conditions, isolation and small rural populations make the problem of pupil transportation a difficult one. An ever-increasing effort to provide equal educational opportunities for all pupils, regardless of their place of residence, has been a basic factor in the reorganization of public school districts. The process of providing such opportunity in a suitable manner requires an organized transportation system for those living at a distance from the school attended.

For many of the pupils in this State now being transported to school daily, the time spent on the school bus is about one-third of the time spent in other school activities. Only as we recognize that this important increment of time has been added to the time allocation already assigned to the work of the school, can we properly interpret the responsibilities of the school system in providing safe, healthful, convenient, comfortable, economical, and educationally acceptable experiences for pupils while they are riding school-operated or school-controlled buses. There is the additional responsibility of providing adequate waiting shelters.

The manufacturers of both chassis and bodies for school buses, which are approved for use in Illinois, have engineered into their products structural and functional features designed for safety. Our Illinois bus specifications equal or exceed the standards approved by our National Education Association. For the protection of pupils our standards require:

- Limited passenger capacity
- Proper weight distribution
- Compliance with motor vehicle laws
- Standard color and lettering for identification
- Applied rub-rails
- Dual rear wheels on large buses
- Tires of suitable and uniform size
- An emergency exit in the rear
- Adequate aisle clearance and seat spacing
- No ceiling projections
- A ventilating system
- Adequate heaters
- Safety glass throughout
- Controlled window openings
- Adequate structural strengths
- Step-well lights
- Grab handle and door stanchion
- Chains
- Repair tools
- Inside and outside rear view mirrors
- Stop arm signal
- Fire extinguisher, flags, flares

First aid kit
 Defrosters
 Drive shaft guards
 Emergency brake guards
 Clearance, cluster and directional lights
 Reflectors, stop lights and tail lights
 Ample generator

To assure that all school buses are maintained in a safe operating condition it is required that all units pass a semi-annual "Safety" inspection at an approved and carefully selected state inspection station testing lane. As evidence of a satisfactory inspection each operating bus must display a dated "Operation Permit" on the windshield. The inspection covers many items to assure precision of operation, elimination of mechanical defects, suitable age and condition of tires, good operation of required safety devices, cleanliness and general good appearance.

The driver of a school bus must observe the following requirements:

Be approved by the directors or the board of education in the district served.

Provide character references.

Have had satisfactory experience as a driver.

Hold a current chauffeur's license.

Pass a satisfactory annual physical examination administered by a physician acceptable to the directors or the board of education.

Be twenty-one years of age or older.

Pass a written examination and a road test as given by the State Highway Police.

Hold a current School Bus Drivers permit which is approved and issued by the State Superintendent of Public Instruction.

Hold a certificate of proficiency in administering first aid as issued by the American Red Cross or other agency approved by the Office of Public Instruction.

Attend such driver-training conferences as are required.

Frequently instruct pupils in procedures which are required to assure maximum safety.

Have available a qualified substitute driver.

Observe state traffic, speed, motor vehicle and driver laws and the regulations of the State Superintendent of Public Instruction to provide for the health, safety, comfort and convenience of pupils who are transported.

Since the pupils, the bus, and the driver are under the direct control of the local district and operating laws and rules of the State, there is ample opportunity for providing and enforcing desirable health and safety standards.

Chapter VII

HEALTH SERVICE AND HEALTH INSTRUCTION FACILITIES

Too little attention has been paid to the effects of school facilities on the health of those who inhabit them. Every effort should be made in all schools to have adequate, well-equipped and clean units for health service and health instruction. School health service and instruction facilities are particularly important in the shaping of pupils' attitudes toward the practice of healthful living.

HEALTH SERVICE

The health service unit should be one of the most conveniently located areas in the building and should be within easy access to the administrative units as well as to the physical education units. The size and number of rooms will depend on the enrollment of the school. In small schools, one room may be divided for counseling, examining and emergency care. In large schools, a unit should include a dressing room, waiting room and/or first aid room (rest room, examining) and conference room as well as toilet facilities, office and storage space. A telephone should be provided.

The students' rest rooms should be supervised and should be separate for boys and girls. Adequate toilet and hand-washing facilities adjoining these rooms are important. Proper light, heat and ventilation are necessary. Cots are needed for convalescent pupils or others needing special consideration and adjusted schedules.

Since some students are able to complete their education only by having rest periods during the school day, some provision must be made for them. Provision should be made for an isolation room or a cot isolated from the other cots for students who are ill with a cold or a contagious disease and unable to be sent home immediately. In small schools, one bed for each 125 students has been found to be desirable. This number diminishes as the size of the school increases, until 12 beds will serve a school of 3,000.

Ample cupboard space for the storage of first aid supplies, record material and other equipment should be provided and such space should be easily cleaned.

Where school space is needed for medical and dental examinations, such space should be provided. Hearing projects require a sound-proof room; vision testing requires a room of suitable length.

HEALTH INSTRUCTION

Direct health instruction is an important phase of education, and, as such, requires an appropriate teaching environment. In the elementary grades direct health instruction is frequently conducted in the regular classroom either by the classroom teacher or by a specialist who comes

in. If a specialist is available and the regular classroom cannot be used, a suitable room should be provided. In secondary schools it is essential that a classroom be made available. The practice of conducting instructional classes in Health on gymnasium bleachers and in other inappropriate and unhealthful places cannot be condoned.

It is helpful if classrooms in which direct health instruction is given are located near the health service unit; their number depends on the school enrollment, the size of classes and the frequency with which these classes meet. They should be equipped with models, manikins, charts, posters and bulletin boards; provision should be made for the use of all types of resource materials including audio-visual materials. Space for reference materials of various kinds and for storage should be ample. If Home Nursing and First Aid are included in the course of study, it is suggested that a wash basin with hot and cold running water be provided; a roll-away bed may be included in the equipment. Special care should be taken to see that these classrooms are particularly healthful places in which to work.

Chapter VIII

PHYSICAL EDUCATION, ATHLETICS, AND RECREATION FACILITIES

INTRODUCTION

The portions of the school plant which are especially pertinent to the development of healthy young bodies are those directly concerned with health service, health instruction, and physical activity. Properly planned and conducted programs of health, physical education, athletics, and recreation are of primary importance to the advancement of the culture and welfare of people, not only from a physiological point of view but from a psychological one as well. The effectiveness of such programs is seriously handicapped by inadequate facilities.

Unfortunately, many existing school plants fall far below the minimum facility requirements for the conduct of good programs of health, physical education, athletics, and recreation. Facilities for such programs are expensive to install and to maintain and require a great deal of space; if they are properly planned, built, and staffed, however, they should be well worth their cost in serving the physical and social needs of the people, school youths, and adults in the community.

The day is gone when school plants were designed merely for the formal activities of the school; schools are neighborhood and community centers and should be designed for community use as well as for school use.

The planning of facilities for health, physical education, athletics, and recreation involves the consideration of many factors. First of all, the needs and resources of the school and the community to be served by the facilities should be considered as well as the total community pattern. Second, planning should be unified and should include the personnel of the local health department, of the medical society, and of the park and recreation units in the community as well as that of the school. Whether the school serves a rural or an urban area, a restricted residential or a tenement district, a large housing development or a farm area, unified and joint planning is of the utmost value in avoiding duplication of facilities and overlapping of purposes. It is common sense economy in the operation, maintenance, and administration of such facilities as well as in the original construction or rehabilitation of them to have unified, joint planning. The help of many technical specialists is necessary. Third, all legal, financial, and administrative responsibilities should be clearly defined, allocated, and understood by all agencies involved in the planning.

Adequate facilities include indoor and outdoor areas; the number and size of units or areas are, of course, dependent on the community and school needs. The size of the groups and the length and frequency of group meetings to be accommodated, the teaching stations required per period, the content of the instructional, athletic, and recreational programs to be conducted, and the relationship of the units, rooms or

outdoor areas to each other and to the entire school plant, are factors to be carefully considered. Previous to the erection or rehabilitation of buildings it is suggested that two publications, *A Guide for Planning Facilities of Athletics, Recreation, Physical and Health Education* and *A Plant Planning Primer for Physical Education Units* be consulted. (See bibliography)

INDOOR FACILITIES

Indoor facilities may be determined fairly adequately by deciding on the number of teaching stations (one teacher in one room working with one group) needed. By dividing the total school enrollment by forty, which is an acceptable class size, the number of physical education classes to be scheduled daily can be determined; by dividing the number of classes to be scheduled daily by the number of periods in a school day, the number of teaching stations required can be determined. For example, a secondary school with an enrollment of 150-300 and class enrollments averaging 25-30 requires the scheduling of six classes daily if the school operates on a six-period day. One teaching station would be required. A secondary school with an enrollment of 600 and with 40 in a class requires the scheduling of 15 classes daily. If the school operates on a six-period day, three teaching stations would be required. An eight-period day will, of course, reduce the number of teaching stations.

These stations may be worked out in any number of ways. One large gymnasium with a folding partition permits two stations. This would make it possible to schedule one station for boys and one for girls at the same time. One auxiliary room or a pool would provide the other station. If direct health instruction is taught by the physical education staff, a health classroom would provide this other station. Choice of facilities and the allocation of them is dependent on many factors and will vary with the needs of the school and of the community to be served. Girls' and women's programs must be given fair and adequate consideration; the same holds true for boys' and men's programs. The varsity program for boys is *only one phase* of a good physical education program.

GYMNASIUMS

School gymnasiums should be considered as having two main uses—the conduct of physical education classes and the conduct of the athletic programs, both school and recreational. Probably one gymnasium will serve both purposes but the designer must keep in mind the fact that the gymnasium will serve a dual purpose. He must also be cognizant of the number of teaching stations for girls as well as for boys.

At the elementary school level probably one activity room will be needed; depending on the needs of the school and the community, this room will vary from a playroom 40' x 60' to a gymnasium designed particularly for a varied program of physical education. There is no need to build a gymnasium suitable for interscholastic competition at this level because the practice of conducting interscholastic programs below the ninth grade is not recommended.

At the secondary school level where it is feasible, two types of classrooms for physical education may be planned—a gymnasium built primarily for instructional purposes and a larger gymnasium built for varsity athletics for high school and spectators as well as for instructional purposes. If only one gymnasium is possible, the larger one is recommended.

The one gymnasium may be a relatively small unit or several small units depending upon the size of the school and the size of classes. At least fifty square feet of floor area should be provided per pupil in the class. Smaller units are not practicable for general physical education activities. The ceiling height in these gymnasiums should be 20 to 24 feet if hanging apparatus is to be used. The latter height is preferable. Calisthenics, tumbling and such activities will not require ceiling heights greater than the ordinary classroom.

The larger gymnasium will conform in general to the construction of the smaller units except that the floor area will be large enough for a standard basketball court 50' x 84' with at least ten feet beyond the court lines on each end (more is desirable) and at least four feet beyond the side lines of the court. The size of basketball courts and other game areas for the various age groups are defined by the official rules. The ceiling height should be at least twenty feet and not more than twenty-four feet if the gymnasium is to be used also for activities requiring hanging apparatus. Suspended running tracks in gymnasiums are obsolete and not recommended.

The planning of gymnasiums is a difficult but an important problem. It is only through proper planning that adequate space for the team games, individual sports, apparatus, tumbling and other activities necessary for the conduct of a varied and worthwhile physical education program can be provided. Instructional, athletic and recreational needs for school and community as well as for summer and winter use should be carefully considered.

In regard to the spectator space required for athletic events, it should be remembered that the complete occupancy of bleacher seats in most gymnasiums occurs so seldom that the cost of providing such facilities must be given careful thought—not only the original cost of building areas required, but the cost of construction and the cost of maintenance. Heating a large amphitheater during the greater part of the school year is costly and uneconomical. Bleachers of the folding type are adequate in most instances, but if a very large seating capacity is required, some efforts should be made to make the greatest use of the areas beneath the permanent bleachers for educational activities, provided such areas are not below ground level. A combination of permanent bleachers and fold-up bleachers is usually the widest choice for large seating areas. In most instances the permanent bleachers will serve the normal spectator load with the fold-up type bleachers being brought into use only when a capacity crowd is in attendance.

It has been suggested by physical education instructors that in this sort of an arrangement a flat deck be provided in place of the permanent bleachers and that fold-up bleachers be used on this level. The flat deck area would also serve as an educational work area the greater part of the time. If such a plan is adopted, a protective railing should be

provided and the width of the balcony should not be less than 18 feet to allow adequate space for physical education activities.

In both types of gymnasiums the rooms should be lighted and ventilated by windows on both sides. The window sills should be kept at least seven feet above the floor. All operating levers for the ventilating of each should be kept high enough from the floor to eliminate hazards to students. The best floor for most activities is wood, preferably maple, laid over a wood subfloor diagonally on wood sleepers or metal clips or brackets imbedded in the concrete. The walls to a height of seven feet should be glazed tile or other non-abrasive material with all corners rounded. Above the glazed walls, cinder block or similar masonry construction may be used. The ceiling should be acoustically treated. The artificial lighting fixtures should be recessed in the ceiling. The apparatus to be installed by connection to the building should be determined well in advance of construction so that proper connections can be provided for hanging apparatus from trusses or ceiling and fastening to masonry walls.

AUXILIARY TEACHING SPACE (Optional)

Auxiliary teaching rooms may be provided at the elementary or the secondary school level; they are separate teaching stations which may be required in larger schools. They do not take the place of regular gymnasiums planned for instructional purposes; however, if additional teaching stations are needed, it is sometimes found advisable to adapt certain areas of the school plant for the conduct of particular activities. Such activities may include wrestling and tumbling, dancing and other forms of rhythmical activity, certain types of apparatus work, golf, bowling, archery, riflery, and roller skating. The space should be sufficiently large to meet safety needs and to provide for the variety of lengths and multiple widths that the conduct of these activities require. If below grade spaces are utilized, attention should be given to the provision of adequate light, heat and ventilation. Such installation should meet local building and sanitary codes governing below grade meeting rooms. They must be accessible from a safety and a convenience standpoint. It is because so little attention has been paid to these factors in present buildings that educational leaders have recommended discontinuing the use of below grade areas; if such areas must be used, they should be remodelled to conform with the standards. In new buildings it is recommended that the use of below grade areas for teaching purposes be avoided.

STORAGE AND OFFICE SPACE

Adjacent to the gymnasium, storage space of generous proportions with double doors to allow easy movement of equipment should be provided for apparatus and for chairs, if the gymnasium is also planned for auditorium use. A convenient place for the storage of chairs is on trucks under stages.

Offices for the instructors, with dressing rooms, toilets and showers should adjoin the gymnasium and drying rooms. A window should be provided between the office and the gymnasium to facilitate supervision.

Since the gymnasium is frequently used for large gatherings, both school and community, there should be easy access to corridors and to the outside of the building via vestibules; also there should be easy access to toilets, check rooms and a balcony without necessitating the opening of the remainder of the building. Particular attention needs to be given to the avoidance of safety hazards and to traffic control.

CONSTRUCTION DETAILS

All details concerning construction should be thought out carefully before building or rehabilitation work is started; some of the specific details requiring special attention include electric outlets; vacuum outlets if a vacuum system is to be used; appropriate ceiling and wall fixtures for the mounting of apparatus, nets and other equipment; properly located and recessed drinking fountains and cuspidors; adequate and easily accessible seat storage space; movable partitions which are sound-proof and motor driven; functional allocation of floor space with appropriate floor markings suitable for the varying uses of the gymnasium; and avoidance of hazardous projections; steps and traffic patterns which would impair the safety of participants and spectators.

LOCKER ROOMS AND SHOWERS

Perhaps the greatest deficiency in physical education plant planning has been the lack of adequate locker and shower facilities.

A modern physical education plant should provide a locker for the gymnasium clothing of each pupil in school. The areas required for these facilities are large and should not be considered the last phase of the plant planning, but the first.

They should not be in basement areas. They should be adequately lighted and ventilated and as much window area as possible should be provided. Cross ventilation and fans should be provided if possible.

Many methods of handling gymnasium clothing have been tried. Perhaps the most satisfactory one provides storage lockers for every pupil and dressing lockers (one to every six or eight storage lockers) of sufficient size to allow the clothing to hang from hooks. Allowance should be made for a free flow of air through all lockers.

For girls' locker rooms, a few units may be arranged in alcoves to provide privacy in dressing for those desiring it or all units may be arranged in alcoves.

Showers must be provided near the lockers. A consideration of both the overhead and walk-way showers is desirable. The walk-way shower should be at least 30'-35' in length with directional changes to prevent pupils from running through the shower lanes. The water can be tempered from warm at the entrance to the walk-way shower, to cool at the exit. A drying room at the exit from the showers will keep the locker room floor dry.

The inclusion of locker and shower facilities at the elementary school level will depend on the needs of the school and the community. Whether or not the 7th and 8th grades are housed in the building, the adequacy of home bathing facilities and the extent of the use of physical education facilities by adults should be determining factors.

The walls of locker rooms should be of masonry construction, and glazed tile or other nonabrasive surface should be used for the walls and shower partitions. Non-slip tile floors or non-slip terrazzo should be laid in all showers and drying areas. Properly hardened and sealed cement floors, while less desirable than non-slip tile, are a good second choice. Clinics, toilets, team rooms, laundries, suit drying rooms and storage space should be provided in connection with the locker and shower rooms as dictated by the size of the school and its policies. Floors of all these rooms should have a pitch of 3 inches in 10 feet to the drains.

In shower rooms for elementary schools shower heads may be lowered to 4'0"—4'6" and no individual shower booths will be necessary below the 6th grade. "Time available for showering, dressing and clothes storage is limited usually to 10-12 minutes. The prescribed number of shower heads is that which is necessary to care for the peak period load in that time. In the group or gang type shower, the girls should be provided with a number of shower heads equal to forty percent of the designed peak period load; for the boys the number should be thirty per cent of the designed peak period load, for example:

40 girls.....	16 shower heads
40 boys.....	12 shower heads

"Shower heads should be installed at least 4' apart, should be a non-clogging type, and the height of spray should be adjustable by the use of a lock. If stationary heads are installed, these should be so placed that the top of the spray will be shoulder height (usually 4'6"—5'0").

"One to three individual shower booths should be additionally provided for girls. The size of the booth should be 3' x 3'6", and these booths should have a minimum of 6-inch clearance between the partition and the floor.

"For boys, if a walk-way or walk-around shower system is desired, the number of shower heads in the shower room can be reduced by one-third. In the walk-way, the shower head must be spray type utilizing metal spray outlets attached to the water pipe and be focused to provide coverage from shoulder height to the feet. These spray outlets must be situated so that a continuous spray will result throughout the length of the walk-way and arranged to provide tepid, warm and cool water as one progresses through the walk-way. The walk-way should be arranged in U shape with a total length of at least 30'—35' and be from 3' to 4' in width. An entrance from the group shower soaping space and egress to the toweling room and swimming pool should be provided.

"The shower should be so designed that a proper mixture of hot and cold water may be obtained and delivered at the various shower heads so that there may be no danger from scalding. Both individual and master control should be provided for all group or gang showers. The booth showers would have individual control. The walk-way should have only master control. Special feature requirements for shower rooms:

Non-slip floor material with covered base.

Floor to drain to a gutter not to exceed six inches in width along outside wall with ample drains. $\frac{3}{8}$ " fall to one foot from center crown.

Gutters to be covered with a non-corrosive durable grill or grate, flush with floor surfaces or recessed, and removable with key or wrench.

All plumbing should be recessed in the wall except valves and heads if a satisfactory servicing method can be devised; if not, exposed fittings and pipe should be tight to wall and well secured.

Liquid soap dispensers installed on wall at shower control valve height at rate of one between two showers, with a container large enough for a day's supply. Piping from tank should be non-corrosive and recessed if possible.

A 1½ inch hose bib to supply controlled temperature of water for cleaning floors should be placed so as to eliminate hazard. (A one inch hose bib is adequate.)

Lighting fixtures should be moisture proof with switch and outlet outside of the shower room.

There should be controlled ventilation for rapid removal of excess heat and moisture.

It is suggested that there be an entrance on the dressing room side and an exit by another opening to towel room."

COMMON ERRORS TO BE AVOIDED

All too frequently, in the past, facilities for physical activity have been built without farsighted planning; when put to use they have been found to have many faults. Some of the factors involved in planning adequate activity facilities which will expedite the carrying out of good programs of physical education, athletics and recreation.

They should be:

Functionally designed with respect to instructional, recreational service, storage and administrative units and not combined with auditorium space;

Built primarily for activity rather than for spectator use, but where spectator space is needed, such space should be properly oriented and usable for activity;

Designed with respect to official rules in regard to length, width and height of playing areas;

Suitable for girls and women and ample space and equipment should be provided for them, including hair dryers;

Planned for community use as well as for school use and careful attention should be given to rooms for activity and meetings as well as to dressing space;

Located in a separate area of the building and have easy and direct access to outdoor facilities from gymnasium and locker rooms via vestibules;

Designed for easy future extension when such may be necessary; constructed of good, durable materials and well constructed;

Free of all hazardous obstructions and projections, particularly stairways; traffic patterns should be carefully considered for community use as well as for school use;

Acoustically treated where necessary, especially in gymnasium and pools and allowance should be made for all fixtures for suspended apparatus, floor and wall apparatus and nets previous to building;

¹ National Facilities Conference, *A Guide for Planning Facilities for Athletics, Recreation, Physical and Health Education*, page 59-60.

Adequately and properly lighted and provision should be made for a means of servicing such lighting in gymnasium and pools; electric outlets should be placed in floors;

Equipped with motor driven and soundproof movable partitions where necessary;

Built with zone heating and ventilating systems;

Properly and adequately floored throughout; flooring varies with use and particular caution is necessary in shower and pool facilities.

SWIMMING POOLS

During the period of World War II the attention of the entire country was focused on a seemingly excessive loss of personnel resulting from the inability of members of the Armed Forces to swim. Many deaths apparently were caused by the lack of ability and experience in jumping from high places which is often necessary when troops enter the water from a sinking ship. Many casualties apparently occurred during the crossing of streams. An intensive effort was made in the many training camps to provide needed instruction in swimming, but, in general, the lack of time available for constructing pools and for giving the necessary instruction proved to be a major obstacle. The schools frequently were criticized for not having included swimming as a part of the program.

The need for the ability to swim and also to dive and jump into the water without injury cannot be over estimated. Such ability frequently means the difference between life and death for the individual and sometimes the difference between rescue and drowning for other persons dependent upon him. Proficiency in swimming is no less a valuable asset in peace time. Swimming and water sports have become increasingly popular as recreational activities. Unlike such strenuous sports as football, basketball, and baseball; swimming is an activity in which people can engage during the major part of their lives. Every one should know how to swim and also how to dive and jump into the water. Methods in lifesaving and first aid should be included as an essential part of the swimming program.

Throughout the United States only a few schools have swimming pools and are conducting courses in swimming and lifesaving. Most of the elementary and secondary schools in Illinois at present are without facilities for giving instruction in swimming. A few schools, however, make proficiency in swimming a requirement for graduation. Instruction in swimming necessitates having necessary but expensive facilities. It is desirable for schools to have a swimming pool as a part of the school plant. In a number of communities, outdoor pools have been provided and certain agencies, such as the YMCA, have indoor swimming pools for recreational and instructional purposes. In a number of communities, natural swimming areas are available. The use of these areas is discouraged because the water is of questionable quality, since direct or indirect sewage outlets may discharge to these surface waters. Physical and bacteriological analyses of water samples from natural bathing areas indicate that in nearly all cases the water is not of safe, sanitary quality. The usual turbidity present in such waters is also a serious hazard to swimming safety since it is difficult, if not impossible,

for lifeguards to exercise necessary vigilance and supervision over all bathers if the water is not clear. In general, however, the schools of Illinois have assumed no responsibility for giving instruction in swimming. The schools of Illinois, with the exception of those in Chicago and a few downstate schools, have no facilities for teaching swimming.

The construction, maintenance and operation of a swimming pool is expensive and for most of the small schools, the cost is prohibitive. In areas where small schools exist, however, communities and schools should work together to provide a pool. If a pool is absolutely beyond realization, much can be accomplished by encouraging and helping young people to attend summer camps where swimming facilities are available and where instruction is provided. The community which can afford a swimming pool should assume the responsibility of teaching young people how to swim, and courses of instruction under competent teachers should become a part of the program of studies and training activities.

Before making the decision to include a swimming pool in the school plant, those in charge must fully realize that the maintenance and operation of a swimming pool requires constant attention and vigilance. PRIOR TO ANY CONSTRUCTION OR IMPROVEMENT WORK ON POOLS, THE ILLINOIS SWIMMING POOL LAW REQUIRES THAT PLANS AND SPECIFICATIONS FOR NEW SWIMMING POOLS OR FOR PROPOSED IMPROVEMENTS TO EXISTING POOLS BE SUBMITTED TO THE DEPARTMENT OF PUBLIC HEALTH FOR REVIEW AND ISSUANCE OF FORMAL PERMIT. Health and physical examinations as well as daily inspection of those making use of the swimming pool must be provided. Effective safety and health rules concerning the use of the swimming pool must be rigidly enforced. The swimming pool also requires adequate shower and dressing rooms.

An important item is the location of the shower rooms with respect to the pool itself. The shower rooms should be so located that the swimmers must pass directly from the showers onto the pool deck. Swimming pool sanitation necessitates the installation of some system of water purification. Intelligent administration of a swimming pool involves making a frequent analysis of the water and checks on water temperature. Such checks must be made at least daily. It is necessary in pool-water purification that a continuous application of disinfectant be employed. Chlorine or bromine is introduced into the water in such quantities as to maintain a free residual of 0.5 parts per million in all parts of the pool. The swimming pool must be equipped with an adequate circulating and filtering system and the floor and side walls of the pool must be vacuumed frequently.

In planning a swimming pool, careful consideration should be given to its location and also to its dimensions. The construction of a pool for the use of expert swimmers and competitive swimming is quite different from that of providing a pool which is to be used for the instruction of beginners. In view of the fact that it is not practical, because of the cost involved, to have two different types of pools, the swimming pool must necessarily be of such construction, capacity and dimensions that it can serve a variety of purposes. Such purposes include

instruction of all kinds, swimming and diving competition, games, water pageantry, synchronized swimming, swimming for the handicapped, and social and recreational swimming including that of families.

A pool serving all these purposes should have one deep end for diving with this part of the pool extended far enough from the diving board to insure safety. If a one meter diving board is installed, the depth of the water should be 10'; if a three meter board is used, a 12' depth is required. There should be a ceiling height of 13 feet above the boards. In a few schools provisions have been made in the construction of the swimming pool for a high platform from which pupils can be given instruction in diving and jumping into the water. If a high diving platform is provided, there must be very careful supervision to prevent accidents. Many school authorities have been unwilling to assume this additional responsibility and have eliminated this feature of the swimming pool.

A large part of the pool, however, should be comparatively shallow, with definite slopes toward the outlet in the deep end. The shallow part of the pool, however, should be deep enough to make the entire pool suitable for the use of advanced swimmers; 3'3" to 3'6" is recommended. Usually the instructor is faced with the problem of instructing large classes. Greater progress in acquiring the ability to swim is made where pupils develop confidence in the water because they know that they can stand on the bottom whenever necessary. The program of instruction is retarded when, because of the depth of the water, all members of the swimming class, with the exception of the one being instructed, must remain out of the pool waiting turns for instruction.

The high school swimming pool should have a minimum length of at least 60 feet one inch, but 75 feet one inch is generally regarded as a more desirable minimum length. In view of the fact that the standard swimming lane is 7 feet in width, the pool should be constructed in multiples of 7 feet with a minimum width of 28 or 35 feet.

The deck around the pool should be at least 10 feet in width with a 20' space provided at the ends of the pool especially where the diving board is located. The deck should be constructed of non-slip material which is easy to keep clean and which does not absorb water. It should be properly sloped for good drainage and easy cleaning.

The swimming pool should be well ventilated, and, if possible, the air should be conditioned in order to provide for the comfort and health of the swimmers as well as the spectators. The artificial lighting should be such as to provide adequate lighting to all parts of the pool. The room should be evenly lighted and there should be no glares, dark spots or shadows. Vapor-proof fixtures should be used throughout. Some pools have been constructed with underwater lighting; if it is provided, the fixtures should be set in water-proof compartments opening from a service or inspection tunnel which surrounds the pool. Precautions should be taken in the installation to prevent the water from seeping into the compartment housing the fixtures. Whether underwater lighting is used or not, adequate lighting must be provided for all sections of the pool's surface and the water must be maintained in such condition that it is clear at all times. The color of the tile used in lining the pool should be light in order to provide the best possible visibility.

Other construction details to be considered are water supply and sewer capacity, overflow drains and gutters, four ladders, three of which are recessed, in the pool sides at each corner, no obstructions of any kind in the pool proper or on the decks, corrugated ramps instead of stairs leading to the pool room, rounded corners and edges, a coping around the pool edge, hose connections for cleaning, recessed drinking fountains and cuspidors, concrete construction with light colored tile and a service tunnel around the pool.

It is highly desirable that provision be made for office, storage space and spectator space and that spectator space be accessible without having to walk on the pool decks. Spectators should not be permitted to walk in the dressing rooms or on the decks of the pool. The entire pool unit should be designed so that it can be operated separately and used apart from the rest of the building when necessary.

COMMON ERRORS TO BE AVOIDED

Commonly reported defects in the construction of a swimming pool are as follows:

- Leakage of water from the swimming pool
- Lack of durability of paints used on ceilings and walls
- Poor placing of entrances and exits which prevent proper control
- Slippery decks which frequently result in accidents
- Inadequate depth of diving area and height above diving boards
- Improper sloping of decks for drainage and cleaning purposes
- Narrow competition lanes
- Inadequate lighting
- Inadequate locker and dressing rooms
- Deficiencies relating to temperature and humidity
- Instructional difficulties resulting from poor acoustics
- The construction of the swimming pool with square corners which handicaps the work involved in cleaning
- Inadequate width of decks
- Poor location of the pool in the school plant

The construction of a swimming pool requires a specialized type of designing and engineering which should be done by experts in the field of swimming pool construction.

OUTDOOR FACILITIES

Modern physical education, athletics, and recreation have moved out-of-doors. Today the indoor facilities are used only during those periods when weather conditions make outdoor activity either impossible or undesirable. The problem affecting the provision of adequate indoor equipment lies in the cost of buildings; while out-of-doors it is the cost of scarcity of land. School boards and other administrators are constantly asking what facilities should be provided for their schools. They are interested in the type, size, and cost of areas needed for the conduct of a good program of physical education, athletics, and recreation. Even if sufficient funds are not available for complete equipment administrators should know what is needed in order to formulate a comprehensive building program.

In elementary schools a separate play area should be planned to accommodate the younger children and should include a level space for informal games as well as a space for sand boxes, slides, and climbing.

An area for boys and one for girls should be provided at the upper elementary level and should be large enough for organized games and sports; another area having a few pieces of play apparatus, rings for marbles, and courts for shuffleboard, horse shoes, and hop scotch may be added.¹

As nearly as it is possible to do so, every high school should provide the minimum of one standard field or court for each team game and individual sport most popular in that section of the State; one hard surface area should be provided. It is also desirable that there be sufficient fields and courts to allow every student to play each day those games which he wishes to play at times that are convenient for and in ways that are beneficial to him. In the larger high schools it is almost impossible to meet this requirement. However, older students are more interested in the individual sports and are more apt to have odd hours available for their recreational activities.

Sports administrators have found that they must not only provide adequate facilities but these facilities must be easily accessible to the indoor facilities and consequently, must be located on the school grounds. Activity and play must be made convenient. Location of fields and buildings is a problem of the first magnitude. Showers, lockers, toilets, drinking fountains, etc., should be accessible to outdoor facilities without using other parts of the building. After-school and summer use should be considered. Activity areas must accommodate required physical education activities, intramural, varsity and recreational activities and must be large enough for the present and future needs of the student body as well as of the surrounding community. The planning of outdoor facilities involves these factors: location of various areas, safety, ease of supervision and control, utility and beauty.

The area for physical education, recreation, and athletic activities in any high school should, if at all possible, be from 10 to 12 acres in extent. To provide activity fields and areas as listed below, approximately 12 acres are needed:²

Oval $\frac{1}{4}$ mile cinder track of standard construction, including a 220 straightaway, 21 feet wide.

Regulation size football field, baseball diamond and softball diamond. Practice areas may be superimposed or interspersed according to needs.

One or more fields for girls suitable for field hockey, field ball, soccer, speedball and softball.

Space for individual and group sports as desired (see table on page 73).

One or more hard surface areas unless provided under individual and group sports area.

Space for permanent stands with a capacity of from one to three thousand, and space for additional temporary seating facilities, as desired. It is recognized that the majority of small schools have temporary

¹ American Association of School Administrators, *American School Buildings*, page 80.

² National Facilities Conference, *A Guide for Planning Facilities for Athletics, Recreation, Physical and Health Education*, 1947. p. 20-21.

seating facilities; permanent ones are recommended because they are safer.

Parking area may be provided not only for spectator events, but also may be used for general parking for the entire playfield. Further, this parking area may lend itself to the development of a safe driving course for driving instruction.

ORIENTATION

The shape and size of the area available for outdoor facilities, the location of other facilities and the general topography will, of course, determine the orientation of outdoor fields and courts. The location of players and spectators, however, is of major importance; *primary consideration should be given to the players.*

In general, the long axis of any field on which balls are used should be at right angles to the rays of the late afternoon sun during the midseason of the sport. For baseball, softball and other similar fields, since the ball's flight does not parallel any axis, the diamond should be laid out so that the home-second-base axis is at right angles to the afternoon sun; professional baseball parks usually have home base located in a southwest position.

Many communities may choose to include hard surface areas for particular purposes or to increase the hard surface areas available. If such is the case, there should be a sufficient number of the principal types of courts to serve a class of 32 to 40; while some pupils are playing tennis others may be engaged in large group games. By proper planning and the superimposing of court markings, provision can be made for the playing of many different games in one area. Basketball courts are the same size outdoors as they are indoors. The following quotation may be helpful:

"The six types of courts are listed in the table below. For example: court type II can be used for badminton, paddle tennis, or deck tennis. Eight courts of this type will serve thirty-two players at one period. Different color lines should be painted on the surface for each game. It is evident that this provision to take care of a full class in any one activity is a good basis for planning physical education courts. The need for such courses in a recreation program is even greater than in physical education because there is a wider range of ages and a greater number of individuals to be served."¹

¹ Ibid. Page 32.

TYPES OF COURT AREAS

Type	Games	No. per court	No. courts	Players per period	Size court	Area size	Acres
I	Captainball.....	14	3	42	30 x 60	50 x 80	.27
	Newcomb.....	16	3	.....	30 x 60	.....	.....
	Volleyball.....	12	3	.....	30 x 60	.....	.....
II	Badminton.....	4	8	32	20 x 44	30 x 64	.32
	Paddle tennis.....	4	8	.....	20 x 44	.....	.....
	Deck tennis.....	4	8	.....	18 x 40	.....	.....
III	Tennis.....	4	10	40	36 x 78	55 x 120	1.70
	Ice skating in winter.....	.....	.....	.....	.....	.....	.....
	Group games when ground is wet.....	.....	.....	.....	.....	.....	.....
IV	Handball.....	4	8	32	20 x 34	40 x 44	.30
	Squash tennis.....	4	8	.....	22 x 36	.....	.....
	Squash racquets.....	4	8	.....	22 x 36	.....	.....
V	Quoits.....	4	5	20	25 - 40*	20 x 74	.17
	Horseshoes.....	4	5	.....	25 - 40*	.....	.....
VI	Lawn bowling.....	6	4	24	14 x 110	60 x 120	.17
	Landscaping.....	.....	.....	.....	.....	.....	.23
	Circulation.....	.....	.....	.....	.....	.....	.....
	Safety.....	.....	.....	.....	.....	.....	.....
	Total.....	.....	.....	190	.....	.....	3.16

* The stakes can be set 40 feet apart for use by boys and men, and pitching lines can be marked at different distances to suit children (25 feet), girls and women (30 feet).

MAJOR CONSIDERATIONS

Baseball and Football Fields: "Where possible, the baseball field should be separate from and outside the running track and football field. The infield of a baseball diamond should be graded so that the pitcher's mound is not less than 12 inches above home plate nor higher than the official rules provide. The pitcher's mound should slope toward the base lines. These should be on a level grade. A desirable location for a football field is within the oval track. The crown of a turf football or similar field should be on the long axis and the slope would not exceed 1½%.

Running track: The subgrade of the running track area should be prepared so as to provide for the proper construction of the track. The bed of the track is generally constructed in three layers as follows:

(a) The bottom layer, of coarse cinders, rubble, broken concrete or similar materials, 5" to 10" in depth, heavily rolled in place.

(b) The middle layer, also 5" to 10", of medium graded cinders, with no coarse material, well rolled in place.

(c) The top layer, 2" to 4" in thickness, usually a mixture of 1 part clay or loam and 3 or 4 parts cinders finely screened through $\frac{1}{8}$ " mesh.

It is advisable to provide solid curbing around the running track.¹

GENERAL FACTORS

For detailed information concerning the construction of the running track, areas for field events, baseball, backstops, and so on, it is suggested that the official rule books and other publications (see bibliography) be consulted. However, in addition to construction details, including dimensions, there are certain general factors to be considered; these include dressing rooms and related facilities for community as well as for school and varsity use, water supply, overall drainage and grading, surfacing, fencing and lighting. In a publication such as this it would be impracticable to discuss them in detail; certain cautions should be pointed out, however, in regard to surfacing, fencing and outdoor lighting.

SURFACING

There is no type of surfacing which is generally satisfactory for all activities; consequently, the cost of initial construction and of future maintenance, the availability of materials and the use to which the various areas will be put will determine the selection of the surface. The effect of the surface on the floor maintenance within the building is also important. Turf, stabilized soils, cement concrete, bituminous concrete, tanbark, local materials and natural soils are types to be considered. Materials such as crushed rock and cinders should be avoided in play areas.

FENCING

Fencing is important from the standpoint of supervision and of protection for players, spectators and adjoining property. Woven wire of the chain link type mounted on rust resistant pipes or steel frames has been found to be satisfactory; it is attractive, effective, durable, stable and economic to maintain. Any other type of fencing which meets these same qualifications is equally satisfactory.

LIGHTING

Outdoor lighting is costly and presents problems of its own but it does extend the use of the facilities; consequently, it is a valuable factor in meeting the athletic and recreation needs of the community. Previous to the selection and installation of lighting equipment, an illuminating engineer should be consulted in regard to the intensity and quality of the illumination needed, the cost and appearance of installation, the efficiency of the system and the cost and ease of maintenance. Wiring should be located underground, moisture-proof lighting units are advocated and lighting units should be provided with guards if they are near ball playing areas. No obstructions should interfere with lines of vision, all glares and shadows should be avoided, and the eyes of players as well as those of spectators should be free from direct light rays.

¹ Ibid. Page 21.

CONCLUSION

Providing suitable and effective educational experiences for children and young people is a tremendous responsibility. Housing pupils during these experiences is merely one phase of this responsibility but certainly an important one. Furnishing an environment which is pleasant, safe, healthful and functional will help education to be meaningful.

It should be possible for every child to experience the joy of working in attractive rooms, to have the security of knowing that he is carefully protected from fire and other hazards, to be able to practice the health habits which he has been taught at home and in school and to realize that his school offers him a variety of opportunities in a building designed for his use.

Members of school boards, school administrators, teachers, parents and many others are faced with the challenge of providing adequate school housing for the increasing school population. It is hoped that the material in this publication will help them to solve the many problems connected with school building and remodelling.

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